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Statistics and Economics.

**AN OUTLINE OF STATISTICAL SCIENCE WITH ESPECIAL REFERENCE
TO THE USE OF STATISTICS IN POLITICAL ECONOMY
AND SOCIAL SCIENCE.**

— BY —

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TABLE OF CONTENTS.

	PAGE.
PREFACE.....	5
I. THE STATISTICAL METHOD CONTRASTED WITH THE HISTORICAL AND COMPARATIVE METHODS IN THE STUDY OF SOCIAL SCIENCE.....	7
II. AN OUTLINE OF STATISTICS.....	14
<i>Part I.</i> —The Statistics of Population.....	14
The Number of the Population.....	16
Race and Nationality.....	21
The Foreign-Born in the United States.....	22
Density of Population.....	26
Urban and Rural Population.....	28
Sex, Age, and Conjugal Condition.....	31
Population according to Age Periods.....	33
Productive and Unproductive Ages.....	35
The Voting Age.....	36
Conjugal Condition.....	38
The Defective Classes.....	40
The Movement of Population.....	43
Increase and Decrease of Population.....	45
Births.....	46
Influences on Births.....	48
Proportion of the Sexes at Birth.....	49
The Still-Born.....	50
The Illegitimates.....	51
Multiple-Births.....	52
Marriages.....	52
The Marriage-Rate.....	54
Brides and Bridegrooms.....	55
Intermarriage of different Confessions and Races.....	55
Fruitfulness of Marriage.....	57
Duration of Marriage.....	58
Deaths and the Death-Rate.....	59
Infant Mortality.....	60
External Influences on Death-Rate.....	61

Deaths from Violence, Accident, and Disease	64
Social Influences on Death-Rate.....	65
Mortality in Occupations.....	66
The Average Length of Life.....	69
The Average Age of the Living.....	71
The Average Age of the Dying.....	72
Life Tables (Mortality Tables)	72
<i>Part II.</i> —Economic Statistics.....	78
Statistics of Production.....	79
Food.....	80
Raw Materials.....	82
Luxuries.....	83
Statistics of Consumption.....	86
The Factors of Production: Land.....	87
The Factors of Production: Labor.....	89
The Productiveness of Labor.....	90
The Division of Labor.....	91
Emigration and Immigration.....	92
The Factors of Production: Capital.....	96
Statistics of Distribution.....	97
Wage-Statistics.....	99
Relative Incomes.....	102
The Statistics of Exchange.....	103
Imports and Exports.....	104
Prices.....	105
<i>Part III.</i> —The Statistics of Vice and Crime.....	108
Kinds and Causes of Crime.....	110
Effect of Penalties.....	111
III. STATISTICAL METHOD OR STATISTICAL SCIENCE?.....	112
The English View.....	113
The Continental View.....	115
IV. THE FREEDOM OF THE WILL.....	119

PREFACE.

The following monograph is neither a handbook of statistics, nor a textbook of statistical science. It does not pretend to give full data on any subject, or to discuss all the questions of statistical method and procedure. It is merely an attempt to put, briefly, into English that conception of statistics which regards them not merely as information, but principally as contributions to the building of a social science.

England and the United States occupy an honorable position in statistical investigation; the former through the long activity of its Registrar-General's office, its Board of Trade, and the labors of such men as Tooke, Newmarch, Neison, Farr, Giffen and many others; the latter through its decennial censuses, especially the tenth, the reports of the Massachusetts Bureau of Labor Statistics, and the efforts of Dr. Edward Jarvis, Francis A. Walker, Carroll D. Wright, etc.

Comparatively little effort, however, has been made in English to popularize statistics as a whole, to bring them into connection with social science, and to present a systematic view of the knowledge of human society which we are trying to gain by the statistical method. This has been done in Germany, France and Italy, by Mayr, Haushofer, Block, Morpurgo and others.

This monograph rests largely on the labors of these men. In particular, the little book by Professor

Georg Mayr, *Die Gesetzmässigkeit im Gesellschaftsleben*, has been closely followed. The whole conception of statistical science, the arrangement of parts, and many illustrations are directly from it; and it would be impossible for me to indicate fully how much I have been influenced by a book so small in compass and so rich in ideas.

Many authorities have been used, a few of which are indicated at the beginning of each section. No attempt has been made to furnish a complete bibliography; and it was not thought worth while to multiply foot notes by giving the origin of each statistical statement. They are taken almost entirely from official documents which are easily accessible. The statistics for the United States are principally from the tenth census; those for Massachusetts, from the state census of 1885; those for Prussia, from the *Zeitschrift des Preussischen statistischen Bureaus*; for Germany, from *Das statistische Jahrbuch für das Deutsche Reich*; and many international statistics, from the invaluable Italian publication, *Movimento dello stato civile*.

It was intended, at first, to give three additional sections:—on the History and Literature of Statistics, on Statistical Bureaux, and on Reform in Statistical Organization and Methods. But the literature on these subjects in French and German is abundant and accessible to the special student, and has just been admirably supplemented by Mr. C. F. Pidgin's *Practical Statistics*, and will be still further supplemented by the same author's *History of Statistics* which is promised next year.

R. M. S.

STATISTICS AND ECONOMICS.

I.

THE STATISTICAL METHOD CONTRASTED WITH THE HISTORICAL AND COMPARATIVE METHODS IN THE STUDY OF SOCIAL SCIENCE.

It is everywhere recognized that induction is playing an important part in the study of the social sciences. Theoretical treatment is out of favor and we hear on every side of inductive social science, of historical political economy, of comparative jurisprudence. Many authors devote their attention exclusively to the study of mere historical facts, with no attempt to formulate principles from them. Some even deny that the time has as yet arrived for the formulation of principles, and look forward to years of laborious investigation on the part of students before we shall have enough material and in such shape that it will be safe or profitable to draw conclusions. Almost every professed student of political economy or political science feels it necessary, in order to vindicate his scholarship, to devote a portion of his time to such investigations even if they cover only a small field. So we have specialists in each department of historical and economic knowledge. Even where one ventures on a systematic treatise he feels obliged to load his pages with illustrations from historical and contemporary sources. .

In this condition of the social sciences one of the most fruitful topics for discussion is as to the various methods of which they are able to make use in order to get the material for their inductions. The validity of the results will depend upon the validity of the methods, and the strength of the argument, upon a due appreciation of what the method can or cannot accomplish. We are wasting our efforts in many directions because we are trying to force out of our methods things which they can never yield. We are so greedy of facts that we accept conclusions unwarranted by the facts. The science not only burdens itself with data which are not perfect enough to be of value, but is sometimes obliged to reverse its own conclusions because it has philosophized too hastily.

There are three methods of which the social sciences make use in order to get material for induction. These are the historical, the comparative, and the statistical. The historical is the one which has been longest in use and which is the favorite at the present time. It is not necessary to define here its exact value. History shows us the past experience of mankind. It reveals on a large scale the forces which are at work in the formation and modification of social institutions. It shows by what motives men are influenced and the strength of those motives. It discloses relations of cause and effect. It gives us indications of the direction of human development and whither we are tending. More than all, it enables us to correct our theories of society. It may be doubted if the study of history has done a more important service in modern times than this : that it has corrected notions

of political and economic theory by the test of past experience. It performs the same service for society that a long life does for the individual man. It prevents our falling into numerous errors and mistakes by the remembrance of past sufferings. History does not repeat itself; but its study is a balancing power which prevents the repetition of the unfortunate experience. It guides the statesman in the conduct of affairs, and the political scientist in the careful elaboration of his theories so that they shall fit the realities. It is the favorite basis of study for political science and jurisprudence, and is also of very great value in economics, although the enormous changes which have occurred in the economic organization,—even more momentous perhaps than those which have occurred in the political—make it of less value there.

The comparative method, also, is a great favorite in political science and jurisprudence. It consists in comparing institutions in different countries for the purpose of discovering how different peoples have solved the same problem. It is of very great value. It broadens our knowledge; it extends our experience; it reveals to us new expedients for meeting unexpected emergencies. In the formulation of principles, it enables us to generalize on the basis of a great mass of facts instead of the limited experience of one nation or one community. In the practical problems of political economy, also, the comparative method is of very great value. In banking, for instance, we compare the experience of the civilized world when we desire to change or to modify our own system. The factory laws have been carried from one country to another and adopted

almost *en bloc*. Often the experience of one country well advanced in civilization acts as a warning to other countries following after. The social discontent of Europe may spur us on to avoid those evils which give rise to socialism. The method restrains the effort to make the principles of political economy cosmopolitan, as the historical method has destroyed the idea of perpetualism. At the same time it reveals what is really common to all civilizations and peoples.

The statistical method differs from the historical and comparative, and gives us results which cannot be obtained by them. They give us qualitative statements of the phenomena of human society; statistics give us quantitative measurements. They give us general descriptions in words; statistics give us exact descriptions in figures. History records the gradual or rapid increase of any country in population; statistics number the inhabitants. History would observe in a general way that after a famine or during a war the growth of population was retarded; statistics would show the degree of retardation and the immediate influence of the famine or the war. Comparison of institutions might show us general results of certain legislation in the restraint of crime. It might be a matter of observation that the infliction of certain penalties had the tendency to decrease criminality, while the infliction of certain other penalties had no appreciable effect. Statistics would show the exact increase or decrease of crime under the different penalties. It was a matter of common observation that the Bavarian marriage laws increased the number of illegitimate births. Statistics showed the exact number, and the decrease

in the amount of illegitimacy as the laws were made more liberal. In all directions statistics come to the aid of the general observations of history and the comparison of institutions by reducing them to exact form. In other words we have exact measurements instead of inexact. In many cases statistics reveal connections of cause and effect which could only be guessed at by history, or comparison of institutions. Many of the common notions about the effect of illiteracy, poverty, and unsanitary conditions on the commission of crime are the direct fruit of statistical observation. So also the doctrine, in many quarters so popular, that crime is largely the result of bad social relations, and not within the real volition of the criminal, has been established, so far as it is established, by the spread of statistical information. This will become clearer if we define at once the kind of knowledge which statistics can give us. This knowledge is of three kinds, differing in importance and in character.

(1) Statistics give us knowledge which can be obtained by mere enumeration or by a succession of enumerations. Examples are: the number of inhabitants in any country at any period; the increase or decrease of the population during successive periods; the productive capacity of a country; the commercial transactions, exports and imports, amount of money, banking facilities, and the general statistics of production, distribution and exchange. All this is the simplest possible work, and requires only a staff of enumerators and legal power to compel an answer to inquiries or the making of certain returns. The results obtained may be used in a great variety of ways,—simply as information, as illustrations of

political or economic progress or the reverse, or as a basis for a line of reasoning as to the proper course of conduct in public affairs. The function of the statistician is entirely subordinate, and he is simply an administrative officer.

(2) Statistics, in the course of these enumerations, often betray certain fixed relations which have the character of natural laws. These relations could not have been discovered by mere casual observation. Such for instance is the number of boys born to the number of girls. We might think from common observation that the number of births would be equally divided between the sexes. Statistics have revealed the fact that there is a constant excess of boys. The expectation of life as calculated in mortality tables is another example of this sort. A small number of instances, such as would come under the observation of one man, would prove nothing in respect to the average duration of life. But a large number of observations gives us knowledge on which we can safely base enormous financial transactions such as life insurance, annuities, etc.

(3) Statistics are sometimes able to trace relations of cause and effect which can be ascertained in no other way. For instance, when we study the price of wheat and the number of marriages, and find that they vary inversely, we come to the conclusion that economic prosperity and well-being are direct determining factors in the number of marriages. So, when in Bavaria we find that the infant mortality is highest in those counties where the mothers are accustomed to work in the field or the factory and feed the children on artificially prepared food, we have the cause of the increased mortality. When

we analyze the illegitimate births according to the religious confession of the parents, we trace the effect of ethical or religious teaching on the social actions of men. When we compare the number of suicides in winter with those in summer, we study the influence of climatic conditions on the minds of men. In this way the statistical method is trying to aid social science to formulate laws of human life. It is evident that these results differ from those obtained by the historical or the comparative methods. Concerning the validity of these so-called laws of society based on statistics we shall have a word to say at the end of this paper, after we have gained some knowledge of the data upon which they rest.

There is one more remark to be made in this connection:—Even where statistics reveal to us no law of social science, they may yet be of value in directing state action. If the statistics of crime, for instance, do not lead to any complete theory of the phenomenon we call by that name, yet the statistics of the effect of certain penalties on the frequency of crime may lead the state to change those penalties. So the statistics of trade and commerce are of value in directing state action in economic affairs. In many cases the statistics are not yet complete nor certain enough to lead to any law, while they do enable us to determine the general direction which the action of the community should take.

The object of this monograph is to sketch the general outline of statistics for the purpose of showing how far we have been directed towards general social laws by means of statistical observation; to comment on these observations so far as they have been of value in directing state action; and to sub-

ject the ordinary statistics to a critical analysis, for many of them do not at all prove what they are supposed to prove. It is hoped that such a treatment of the subject from a scientific standpoint will be of value when statistics are being so generally made use of in all branches of social science. At the end of this practical part I shall touch upon various matters of theoretical interest.

II.

AN OUTLINE OF STATISTICS.

It seems best to follow the common arrangement and divide the subject into three parts: (1) Population Statistics; (2) Economic Statistics; (3) Statistics of Vice and Crime.

PART 1.—THE STATISTICS OF POPULATION.¹

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- ¹ Literature: Haushofer, *Handbuch der Statistik*. 2nd Ed., 1882.
 Mayr, *Die Gesetzmässigkeit im Gesellschaftsleben*.
 Kolb, *Handbuch der Statistik*.
 Brachelli, *Die Staaten Europa's*.
 Levasseur, *Statistique de la superficie et de la population des contrées de la terre*. Bulletin de l'institut international de statistique, 1886 and 1887.
 Keltie, *Statesman's Year Book*, 1888.
 Tenth Census of the United States, Vol. 1.
 Census of Massachusetts, 1885, Vol. 1.
 Statistisches Handbuch für den Preussischen Staat.
 Annuaire statistique de la France.
 Journal of the Statistical Society of London.
 Zeitschrift des Preussischen statistischen Bureaus.
 Statistisches Jahrbuch für das Deutsche Reich.
 Farr, *Vital Statistics*.
 C. F. Pidgin, *Practical Statistics*.

It is advisable to begin with the statistics of population for several reasons: In the first place, on account of their great practical importance in statesmanship and in political and social science. The population is the basis of the state on which its power rests. Wealth is created by the people, and the economic institutions of a country are largely modified by the number and character of the population.

In the second place, population is an especially favorable field for statistics because one can use the statistical method, that is, the observation of numerous instances, to the very best advantage. Thus in enumerating the population, in describing it according to its characteristics, sex, age, conjugal condition, births and deaths, marriages, emigration and immigration, etc., the statistical method alone is applicable. The historical and comparative methods are of little advantage.

Again, more attention has been paid to these statistics than to any other. We have a great number of observations, extending over more than a hundred years, so that our material is more complete in this part than in either of the other two. In Europe especially, the attention of statistical bureaux and of theoretical writers has been largely confined to what are called vital statistics. In the United States our observations have not been so complete owing to the lack of any continuous registration of births, deaths and marriages, but the census of 1880 made some new and very interesting efforts in this direction.

Finally, the study of the statistics of population forms a sort of transition from natural to social

science.¹ As an individual, man is subject to natural law. Births and deaths are, in the single case, pure process of nature. Man in the aggregate, however, is a social phenomenon, and births and deaths are social phenomena—dependent on the laws, manners and customs of the community. We stand here as it were, with one foot on natural and the other on social science. Here, also, we can gradually approach the question of free-will which is so troublesome in some portions of statistics. In regard to the sex of infants we can as yet trace no exercise of the freedom of the will. In the regularity in the number of still-born year after year, there seems to be an indication of absence of any freedom of the will. How is it with the number of illegitimates, which also remains constant from year to year? Marriages show the same regularity as deaths. Are they equally the product of outside influences? But these examples are easy compared with those we shall encounter when we come to the statistics of vice and crime, and it will be advantageous to meet the question before we get into the region where ethical interests seem too deeply involved to allow us to give an unprejudiced answer.

The Number of the Population.

The first thing in statistics of population is to ascertain the number of inhabitants in each country. This can be done by estimating the number or by actual enumeration. In former times the method was almost always that of estimate. Even now when we make statements as to population pre-

¹ Mayr, *Die Gesetzmässigkeit im Gesellschaftsleben*, S. 97.

vious to the present century they are always of this sort. As bases for such estimates Haushofer mentions the following facts which are supposed to stand in some sort of constant relation to the total population:—the number of families, the number of houses, of hearths, of men of military age; the number of births, of marriages, or of deaths; the yield of certain taxes, or the consumption of certain necessities of life. Sometimes the inhabitants of a portion of the territory are enumerated and the rest are calculated proportionately.¹ An interesting example of such methods is the recent essay by Professor F. B. Dexter, "Estimates of Population in the American Colonies." The basis for the earlier numbers is either the tax list, the list of polls, or the enumeration of the militia. Censuses were generally unpopular in the colonies because they were commonly for the purpose of fiscal impositions, often on the part of the mother country.

Such estimates are always very uncertain, because the supposed relation between the known fact and the whole number of people may or may not be true. For instance, it is not at all probable that the proportion of houses to the entire population, or the birth, or death, or marriage rate was the same during the middle ages that it is at the present time.² It is still less probable that the per capita consumption of any article of food was the same then that it is now. All estimates of historians as to the population of cities or countries are to be taken with great allow-

¹The Tenth Census proceeded in this way in its statistics of foreign parentage. Tenth Census, vol. II.

²Jastrow, *Die Volkszahl deutscher Städte zu Ende des Mittelalters und zu Beginn der Neuzeit*, Berlin, 1886.

ance. The figures given by contemporary writers are not to be relied upon. Levasseur prints a curious table showing the estimates which have been made at different times of the population of the earth. The population of the entire earth was estimated by:¹

Riccioli.....	in 1660 at 1,000 millions.
Vossius.....	" 1690 " 500 "
Voltaire (dict. phil.).....	" " 900 "
Süssmilch.....	" 1765 " 1,080 "
Wallace.....	" 1769 " 1,000 "
Moheau.....	" 1778 " 950 "
Volney.....	" 1804 " 437 "
Malte-Brun.....	1804-1810 " 640 "
Almanach de Gotha.....	in 1810 " 682 "
Hassel, (Statistischer Umriss).....	" 1825 " 938 "
Stein.....	" 1825 " 884 "
Balbi.....	" 1828 " 847 "
Almanach de Gotha.....	" 1829 " 847 "
Berghaus.....	" 1843 " 1,272 "
Dictionnaire de Meissas et Michelot...	" 1845 " 1,009 "
Dieterici.....	" 1859 " 1,288 "
Behm.....	" 1866 " 1,850 "
Behm und Wagner.....	" 1874 " 1,391 "
Levasseur (Annuaire du bureau de longitudes).....	" 1878 " 1,439 "
Behm und Wagner.....	" 1883 " 1,433 "
Levasseur.....	" 1886 " 1,483 "

The figures for many parts of the world are at the present time mere estimates. For Africa we are dependent on the opinion of travellers, who see only a portion of the country generally along the banks of a navigable river where the population would naturally be the densest. The figures for China and India vary many millions from one estimate to another. Even where they have a census, as in the Turkish Empire and some parts of South America,

¹Bulletin de l'Institut international de Statistique, T. II., 2^{ème} liv., p. 238.

the results are not altogether accepted by statisticians, for the statistics may be imperfectly taken, or manipulated for fiscal or electoral purposes.

In Europe and North America, since the beginning of this century, we have a series of enumerations conducted with more and more care, so that for these countries the results are on the whole satisfactory. The United States began with its decennial census in 1790, England followed in 1801, and the other countries of Europe have followed with regular enumerations at stated periods, every ten or five or three years. In countries where they have an enumeration of births and deaths, and statistics of emigration and immigration, they are able to estimate pretty closely the population for the years between the census years.¹

After we have established a census or enumeration of the people, it is necessary to determine when and where and whom to enumerate. Shall we number all the persons present in the territory of the state at a certain time, whether citizens or strangers? Shall we take them where they happen to be found, or where they are legally resident? Shall we attempt to ascertain the number of citizens who are abroad at the time of the enumeration? All of these questions are sufficiently puzzling to a census office, and

¹Most countries have a census once in ten years: thus Belgium, Switzerland, Austria-Hungary, Sweden, Denmark and the United States, in 1880, and so on; Great Britain, Italy, Bulgaria, Canada, Venezuela, India, Australia and Algeria, 1881 and so on; Germany every five years, 1880, 1885, &c.; France, 1881, 1886. Down to 1867 the principal countries of Germany took a census every three years. The tendency now is to fix on the decennial periods 1880, 1890, &c. See complete table of censuses since 1800 by Levasseur, *Bulletin etc.*, 1886, p. 24.

they often affect the comparability of censuses of different countries. As regards the time allowed for the enumeration, it is generally agreed that it should be as short as possible. In our census of 1870 the enumerator was allowed from the first of June to the tenth of September to complete his lists. During such a period people are liable to change their residence and either be counted twice or escape enumeration altogether. In the census of 1880 the time was reduced to one month in the rural districts and to two weeks in the cities.

In respect to the persons that shall be enumerated, it is the custom to take, first, the total number of persons actually in the country at the time of the census and then make various sub-divisions. The different possible combinations are well illustrated by the following table of the population of Prussia according to the census of 1880:

Inhabitants of Prussia: according to domicile, (dem Aufenthalt nach.)

(a) Persons actually present (Ortsanwesende).....	27,279,111
(b) Resident in the place (am Zählort wohnhaft).....	26,936,799
(c) Resident elsewhere (anderswo wohnhaft).....	342,402
(d) Absentees (Orts-abwesende).....	287,208
(e) Resident population (Wohn-Bevölkerung).....	27,273,917

Inhabitants according to citizenship (Staatsangehörigkeit nach).

Prussians.....	27,016,763
Other Germans.....	163,390
Foreigners (Reichsausländer).....	98,958

By combination of the different numbers we can ascertain any desired fact about the distribution of the population of Prussia by place or nationality.

Race and Nationality.

The population may be analyzed in various directions: for instance, according to race, nationality, or place of birth. The ethnological distinction is one difficult to follow statistically where different races are inhabitants of the same country and have intermingled in blood or adopted the same language. The division of the inhabitants of Europe into Germanic, Latin, and Slavonic, besides various minor races such as Magyars, Finns, Tartars, Turks etc., rests on the most general estimate and on no exact enumeration. It is also of only the most general ethnological interest. The composition of the population of any single country, on the other hand, often has great political importance, for there must be a certain homogeneity of the population in order to have a harmonious and stable political life. These distinctions are commonly based on language. Countries of Europe show wide differences in this respect. In France 93 per cent of the inhabitants are of French nationality. In Germany 92 per cent are of German blood. In Switzerland we have a great mixture: 69 per cent are Germans, 24 per cent French, and 5 per cent Italian. Austria presents a mixture of populations that makes any homogeneous development and any strong national feeling extremely difficult. The different elements are represented in the following proportions: Germans, 30 per cent; Czechs, 16 per cent; Magyars, 14 per cent; Ruthenians, 9 per cent; Kroats and Servians, 9 per cent; Romanians, 8 per cent; Poles, 7 per cent; there are besides, Slovenians, Armenians, Albanians, Italians, Israelites, Zigeuners, Bulgarians, Greeks,

etc. The great difficulty is that no one nationality is sufficiently strong to attain a dominant position over the others.¹

In the United States the distinction of race can be followed out satisfactorily only in one direction—that of color. We can distinguish the black from the white, including among the blacks all who have any negro blood such as the mulattoes, quadroons, etc., although in the Massachusetts census they distinguish between the blacks and the mulattoes. We can also distinguish the Chinese, Japanese and Indians, in the same way. In 1880 there were 6,580,793 colored; 105,465 Chinese; 148 Japanese; and 66,407 Indians. Inhabitants of Indian territory and of Alaska, and Indians not taxed are omitted. The negroes alone are of importance to us in this connection. It is not necessary to insist upon the gravity of the ethnological, political and social problem presented by the presence of this great body of persons of an inferior race, which we can never hope will amalgamate in blood with the white population. The study of its condition, its rate of increase, its distribution, its economic progress, its moral characteristics should be one of the constant problems in a properly managed statistical bureau of the United States.

The Foreign-Born in the United States.

Among the whites in the United States the distinction of race can no longer be followed out. Peoples of different nationality and blood have adopted the same language and habits of life and become

¹All the above data from Brachelli, *Die Staaten Europa's* 3rd. edition.

largely intermingled. The only way we can distinguish them now is by place of birth. The statistics of 1880 are well known. Only the principal nations need be given :

Total foreign-born.....	6,679,943
Born in German Empire.....	1,966,742
“ “ Great Britain.....	2,772,169
“ “ England.....	662,676
“ “ Ireland.....	1,854,571
“ “ Scotland.....	170,136
“ “ Wales and not specified....	84,786
“ “ British America.....	717,084
“ “ Sweden.....	194,337
“ “ Norway.....	181,729
“ “ France.....	106,971
“ “ China.....	104,541

No other country has more than 100,000.

It is not proposed to delineate here the influence of this enormous number of foreigners in the increase of population, their distribution throughout the country, their concentration in large cities, their representation in different industries, their contributions to the defective and delinquent classes. All this has been done in the tenth census of the United States, and on a small scale but very carefully in the Massachusetts census of 1885. The statistics are of great interest in political and economic science, and we have here a domain which the European statisticians are not able to touch because they have not the phenomena. There are one or two points of ethnological interest which may be mentioned here. They are as follows :

(a) It is impossible to distinguish between the different ethnical elements in the United States. We can, however, speak of the native American stock and the foreign stock. For this purpose it is necessary

to distinguish between the descendants of the original colonists and the more recent immigrants. In one sense we are all the descendants of immigrants. But there is a wide difference between those who came here when the country was a wilderness and who underwent all the dangers and hardships of the settlement, and those who came after the wilderness had been subdued and the state and social institutions established. The line between the two may be conveniently drawn about 1790 when the state was finally established in its permanent form. The early settlers were left alone for so long a period that they acquired characteristics which distinguish them sharply from those who came in later years. They may be called the American stock. How many of the present inhabitants of the United States are descendants of this American stock? In the absence of a general registration of births and deaths it is impossible to answer this question statistically. The only data we have are the decennial enumerations of the people and the statistics of immigration since 1820. Calculating a rate of increase by taking the actual increase each decade less the increase due to immigration, and applying it to the white population of 1790, we would have in 1880, a total of 25,000,000 whites as representing the original American stock,—about one-half of the population.¹

(b) The foreign element in the United States tends constantly to increase. It is sometimes said, that while in 1870 the proportion of the foreign-born was 16.8 per cent of the native, in 1880 it was only 15.36

¹See an article by Dr. Edward Jarvis in the *Atlantic Monthly* for April, 1872.

per cent, and that therefore the foreign element is not increasing as fast as the native. It must be remembered, however, that the children of the foreigners, if born here, are classed as natives. The consequence is that immigration has to offset not only the mortality of the foreign-born and the productivity of the native-born, but also the natural increase of the foreign-born themselves. It requires an enormous immigration to do this, and it is not surprising that the proportion of foreign-born shows some slight falling off. But the number of persons of foreign descent is constantly augmenting owing to immigration and to their own natural increase. It is still an unsettled question whether women of foreign descent are more fruitful than the American women. The recent returns of the Massachusetts census seem to show that the foreign-born women have a larger number of children, but that there is a greater infant mortality among them. But if they only hold their own, that, with the continuous immigration, will constantly increase the relative strength of the foreign element. Of course all this is only from the standpoint of statistics. It is not necessary to say that these immigrants or their descendants become many of them the very best kind of Americans.

(c) It may be said, that these foreigners intermarry with the natives or with other nationalities and that thus we are forming a new nationality which will be distinctively American, and which will possess that strength which is often the characteristic of mixed races. We have some data on this point from the tables of parent nativity given in the federal census of 1880 and the Massachusetts

census of 1885. It appears that there are a number of persons who are the children of such mixed marriages, but that, for the first generation at least, the persons of the same nationality generally intermarry. It must be remembered in using these statistics that many of the marriages have already been contracted before the emigrants left home, when there was practically no choice in the matter. Possibly in future generations there may be a greater tendency to marry with natives, but at the present time many of the nationalities are so numerous represented that the tendency is to perpetuate the same blood. Ethnologically this is to be regretted.

Density of Population.

It is customary to divide the population of any country by the number of square miles it contains, and thus arrive at the average density of the population. This bare figure is greatly overvalued, for the density commonly depends upon whether the land is inhabitable or not, and that is merely a matter of physical geography. For instance, if we take the whole area of the United States the density is 17 persons to the square mile; while if we take only the actually settled area, it is 32 to the square mile; and if we take only the Eastern group of states, it is 60 to the square mile. Thus Levasseur gives the density of population of the world as 28.3 to the square mile; in Europe as 88.4 to the square mile; in Asia, 49.4; in Africa, 15.6; in North America, 8.8; in South America, 4.4; and in Australasia, 9.1 to the square mile. But in one portion of Europe, (Belgium), the density runs up to 520 to the square mile, and in

some parts of Asia, China for instance, the density is very great. So also the attempt to find the center of population is perfect nonsense. After you have found the exact locality, the distribution of population which causes its location is determined by so many influences that the information is practically of no value.

The distribution of population by density is controlled principally by economic considerations. Thus in Europe, the most densely populated portions are the valley of the Po in upper Italy, the valley of the Rhine including Belgium and Holland, Saxony, and the English counties between the mouth of the Thames and Liverpool. The causes of the dense population in these parts are the fertility of the soil, the facilities for commerce and the presence of manufacturing industries. In early times, commercial facilities had great influence in determining the distribution of population. If one examines the movement of population in the United States during successive decades, as depicted in the series of maps of the tenth census, it will be found that the Western movement was up the valleys of the Mohawk and the Susquehanna, and, after crossing the Alleghanies, down the Ohio to its mouth, and then up the Mississippi and the Missouri, the Arkansas and the Red rivers. That movement was before the building of railroads, when the rivers were the natural highways.

There is no natural law controlling the distribution of population, other than that of economic advantage; and all the different methods of studying its distribution by latitude and longitude, by drainage basins, by topographical features, by altitude, by temperature

and by rainfall, so elaborately carried out in the tenth census only emphasize this fact. Thus if we distribute the population of the United States according to latitude, we find 58 per cent of the inhabitants living between the 38th. and the 43rd. degrees. But between these parallels is where the continent is widest. It includes almost all the great cities, and covers the most fruitful strip of agricultural land in the whole country, together with the industrial regions of the Eastern states. As a matter of course the population will be densest in this region, not because of its latitude but because the inducements to population happen to fall together. If, as in England for instance, agriculture were in the South and manufacturing at the North, we would find no such concentration of population in latitude. In fact, when we come to study the population of the United States according to longitude, we find no concentration of that sort, because the manufacturing is largely East while the agriculture is West, and particularly because the trend of the Atlantic coast from the northeast to the southwest throws all the coast cities into different longitudes. So altitude, rainfall, and temperature do not of themselves cause the density. It is the combination of all these things, together with the accessibility of the country and its general attractiveness, that determine the distribution of population.

Urban and Rural Population.

The density of population offers some points of interest to political and social science. Very thin population commonly means a backward state of civilization, (hunting, fishing and cattle-raising), or

else a poor soil, an inaccessible region, or a harsh climate.¹ From whatever cause, it carries with it political weakness. A denser population, distributed over the land, means agriculture, together with some trade and manufacturing. Very dense population means manufacturing, or commerce on a large scale. This implies great wealth, high civilization, political power, commercial interests. It also means a working class, radical political aspirations, crime, vice and misery. Where we have a dense population it is generally accompanied with large cities, and this is a fact of the greatest importance in political and economic science.

It is difficult to classify the population into urban and rural on account of the varying definitions of the term city. In Europe the statistical congress recommended the number 2000 as the minimum limit for a city or urban population; but this classification has not been universally adopted. On this basis the percentage of urban to the whole population was:²

In Holland (1868).....	80.2	In German Empire (1880) 41.4	
" Belgium (1867).....	64.0	" Prussia.....	" 42.0
" Great Britain and Ire-		" Bavaria.....	" 27.7
land (1871).....	53.1	" Saxony.....	" 56.6
" England and Wales. 61.2		" Hamburg.....	" 94.0
" Scotland.....	57.1	" Switzerland.....	" 44.0
" Ireland.....	19.0		

Later statistics for England and Wales show that, in 1881, 66.6 per cent of the population were living in places of 3000 inhabitants and over. London alone

¹See Tenth Census of the United States, vol. I., Introduction.

²From Brachelli. p. 76. The figures for Germany from Statistisches Jahrbuch für das Deutsche Reich, 1882.

comprised 14.69 per cent of the total population of England and Wales. This concentration of population in large cities is constantly increasing. In 1801 the city of London comprised only 10.78 per cent of the total population of England and Wales. During the ten years from 1871 to 1881 the population of city districts in England and Wales increased 19.63 per cent; while the population of country districts increased only 7.36 per cent. In no country is this increase of city population better illustrated than in the United States. In 1790 only 3.3 per cent of the population were living in cities of 8000 inhabitants and over, while in 1880, 22.5 per cent were living in such cities.

This increase of urban population in modern times is due to industry and commerce. This is especially noticeable in such a country as England, which has had an immense development of that sort during this century. It is also seen in the United States. The development of railroads and other means of transportation has had the effect of increasing the city population, because they tend to a concentration of business. A very curious result is yielded by comparing the urban population of an old country like Germany, where the cities were started before the introduction of railroads, and that of the United States, where many of them have reached their growth since then. It is not possible to make an exact comparison because the classification is different. We can, however, reach some facts of interest. On the whole, the urban population of Germany is greater than that of the United States. In Germany, 28 per cent of the population live in towns of 5000 and over, and in the United States 26 per cent

live in towns of 4000 and over. On the other hand we find that in Germany the small towns preponderate, and in the United States the large cities. In Germany, 116 towns of 20,000 inhabitants and over have 7,300,229 people, or 16 per cent of the total population, while in the United States, 100 towns of 20,000 inhabitants and over have 9,084,262 people, or 18 per cent of the total population. That is, in Germany the large towns average only 63,000 inhabitants each; in the United States they average 90,000 each. The large number of cities of moderate size in Germany is due to their slow growth and the political disintegration which gave rise to numerous political centers. In the United States, the railroads have benefitted the large cities at the expense of the small.

Population according to Sex, Age, and Conjugal Condition.

There are various characteristics of a population that are of interest in economic and social respects. These are its composition according to sex, according to age periods, and whether the persons composing it are married or unmarried. The distinction most easily arrived at is that of sex. We might expect that the number of males and females would be about equal. Statistics show us that in most of the countries of Europe there is a constant excess of females. But the countries vary greatly in the proportion of this excess. For every 1000 males there are in Europe 1021 females; in England and Wales 1054, in Scotland 1096, in Ireland 1044, in Sweden 1067, in Norway 1036, in Germany 1039, in Bavaria 1049,

in Baden 1052, in Württemberg 1071, in Prussia 1033, in Switzerland 1046, in France 1008, in Belgium 995, in Italy 989, in Greece 933 females. In the United States, on the other hand, there are only 965 females to 1000 males. In the Eastern states there is an excess of females (Massachusetts 1077 females to 1000 males), while in the West there is an enormous excess of males, (Colorado only 504 females to 1000 males).

The excess of females over males in Europe is due to two causes. One is that there is a greater mortality among men than among women because of military service, dangerous occupations and addiction to vice and crime. The second is emigration, which carries off more men than it does women. The disproportionate number of females increases with advancing years, as is shown by the following table for Germany giving the number of females to 1000 males at each age :

Age.	Number.	Age.	Number.
0 to 5 years.....	995	30 to 40 years.....	1,051
5 to 10 "	1,002	40 to 50 "	1,060
10 to 15 "	996	50 to 60 "	1,109
15 to 20 "	1,012	60 to 70 "	1,130
20 to 25 "	1,037	70 to 80 "	1,160
25 to 30 "	1,047	Over 80 "	1,238

Mayr declares that nature tries to remedy this inequality, as for instance :

In France in 1821 there were 48.57 men and 51.43 women per 100 of population.

In France in 1872 there were 49.81 men and 50.19 women per 100 of population.

That is, the destruction of men caused by the Napoleonic wars had almost been made good. The differences in different parts of Germany, Mayr thinks, is

due to the great infant mortality in South Germany, which presses more severely on the boys than it does on the girls, and brings about a greater excess of women in Bavaria, Baden, and Württemberg than in Prussia. No influence of climate has ever been successfully proven, although the reversal of the usual rule in the southern parts of Europe, Italy, Servia and Greece, would seem to point in that direction.

The general excess of males in the United States is due to immigration. It is strongest in the newly settled states and territories. In the East and South we have the excess of females observable in the countries of Europe and doubtless due to the same causes, increased mortality among men, and in some states, Massachusetts for instance, the immigration of females to work in the factories and as domestic servants, and the emigration of males.

Population according to Age Periods.

This is of great interest in political and economic respects. If population were stationary, that is the births just made up for the deaths, and if the deaths occurred in regular proportions from year to year, the age structure of a population might be represented by an equilateral triangle. But none of these things occur. In any growing population the number of births from year to year is increasing, so that the base of the triangle is broadened out. So also the mortality is greater in the years of childhood than in later years, which causes a rapid sinking in of the sides of the triangle towards the base. Special causes also come in :—A war or an epidemic may have weakened one generation, and it carries the evidence of that weakness to the end ; emigra-

tion carries away people of middle life, and causes the sides of the triangle to fall in; immigration, on the other hand, adds to the people of middle age, and causes the sides of the triangle to bulge out. Cities are like countries having a large immigration, because the rural youth are accustomed to flock to them. The following table, although not all the figures are of recent date, will illustrate national characteristics in this respect. Out of 1000 of the population there were :

Age	In Germany, 1870.	In England, 1871.	In France, 1872.	In Sweden, 1870.	In U. S., 1880.	In U. S., 1870.	In U. S. Native 1870.	In U. S. Foreign 1870.
0-5..	139	135	93	118	138	143	164	15
5-10..	114	119	91	116	128	124	140	31
10-15..	103	107	87	106	114	124	138	37
15-20..	93	96	84	91	100	104	110	60
20-25..	86	88	88	79	102	96	94	110
25-30..	73	78	72	73	86	79	71	129
30-40..	130	128	139	131	127	126	105	247
40-50..	104	100	125	119	90	90	77	190
50-60..	80	73	104	85	60	58	50	102
60-70..	53	47	72	51	36	32	29	49
70-80..	21	22	36	26	15	13	12	17
80-90..	4	5	7	5	3.7			
Over 90	0.2	0.4	0.4	0.3	0.5			

In Germany, and the United States the lowest age class is very well filled, owing to the large birth rate. The enormous number of children under the head of U. S. native is due to the fact that the children of immigrants, born on this soil, go to swell the number of natives and so to increase the proportion of children. This also explains the small number of children under the head of U. S. foreign, for it would include only immigrants of that age, who are comparatively few in number in any year. In France, they have a small number of children and hence the middle age classes are much better filled out. Something of the same sort is seen in Sweden, where they marry late and have a small number of children. In

most countries, more than one-half of the population are under 25 years of age. The only exception in this table is France.

Population may be still further classed in regard to age so as to bring out the number of productive and of unproductive age, of military, voting, school, child-bearing age, etc. The most interesting of these are the productive and unproductive, and the voting age.

Productive and Unproductive Age.

To the economist, a population has two unproductive periods, that of childhood and that of old age. Between these lies the productive period. The relative length of these three periods is of great interest, for during the productive period the population must pay the expenses of both unproductive ones. The greater the number of persons in the productive period, the easier the burden of supporting the unproductive. It is impossible to say just when the child becomes productive and the old man becomes unproductive. That varies with individuals. The common classification is: under 15 years, from 15 to 70 years, and over 70 years of age. The following table shows the distribution of population according to those ages:

COUNTRY.	Under 15 years of age.	Between 15 and 70 years.	Over 70 years.
Germany.....	35.6%	61.9%	2.5%
England.....	36.1	61.2	2.7
France.....	27.	68.7	4.3
Sweden.....	34.	62.9	3.1
Italy.....	32.4	64.6	3.0
United States.....	38.	60.1	1.9
United States Native White....	42.6	55.6	1.8
United States Foreign "	6.4	90.3	3.3

The persons in the unproductive ages are nearly always one-third of the population. The only exception is France, where the peculiar distribution of the population again manifests itself. It must be remembered, however, that this table includes both men and women, so that it cannot be applied to the question of wages. When we come to consider the real bread-winners, the estimate of the Prussian bureau of statistics is more accurate. That estimate is, that for every 1000 men between the ages of 15 and 70 there are 2282 women, children and old men, so that where we exclude women and children from the factory a man's wages must be sufficient to support himself and 2.2 persons besides. The question is of great interest when we are considering the practicability of enforcing factory laws excluding women and children, and reducing the number of hours of the men.

The Voting Age.

The proportion of males of voting age to the whole population is sometimes of interest. In Germany, where the age requirement is 25 years, the proportion of voters is 23.2 per cent of the whole population. In the United States the absolute numbers and proportions of males 21 years and over in different classes of the population are as follows:

Of total number of males.....	12,830,349	or 25.5 per cent.
" native white males.....	8,270,518	" 22.4 " "
" foreign white males.....	3,072,487	" 46. " "
" colored males.....	1,487,251	" 22.6 " "

These figures do not represent the real voting population. Many of the persons do not possess the right to vote; others never exercise it. Of those

who are of legal age but are disqualified from voting we have interesting statistics for Massachusetts (1885). In that state, polls are males of 20 years of age and over. We have then the following distinctions:

Total number of polls, 567,959 or 29.24% of the population.
 Legal voters, 442,616 or 77.93% of the number of polls.
 Native polls not legal voters, 26,216 or 4.62% of the number of polls.
 Aliens (foreign males over 20 years, not naturalized) 99,131 or 17.45% of the number of polls.

The Irish constitute 35.91 per cent of these aliens, the English 10.59 per cent, the French Canadians 17.44 per cent, and the Nova Scotians 8.78 per cent. But the foreign-born show very different inclination to get naturalized, as shown by the following table:

Of the foreign-born 20 years of age and over, (1885),

French Canadians,.....	17,292	out of 22,427	or 77.10%	are aliens.
Germans.....	4,473	" "	10,908 " 41.01	" " "
Italians.....	1,874	" "	2,190 " 85.57	" " "
Portugese.....	2,175	" "	2,898 " 75.05	" " "
Swedes.....	2,889	" "	4,013 " 71.99	" " "
English.....	10,502	" "	23,339 " 45.00	" " "
Scotch.....	3,262	" "	6,556 " 49.76	" " "
Irish.....	35,600	" "	98,199 " 36.25	" " "
Total foreign-born	99,131	" "	206,227 " 48.07	" " "

Many of these aliens have not been in this country long enough to be naturalized; others have no desire to vote. It would be interesting in a census of the United States to follow out the foreign-born,—how many of them have been in this country long enough to be naturalized, and of that number how many have neglected to do so. This would give us interesting information as to the political influence of the different nationalities of immigrants. We could also tell, by the number of votes cast at an election, how

far the right of suffrage is actually exercised, which we are unable to do with the present statistics.

Conjugal Condition.

The conjugal condition of the community is, to a certain extent, indicative of its prosperity. Where an abnormal number of persons are unmarried it may have an effect on the growth of population, or give rise to social evils such as illegitimate births and prostitution. Most of these things come out more clearly when we study the marriage-rate and the ages of persons getting married. If we take the whole population, about sixty per cent are unmarried. It is evident, however, that in the whole population are included a great number of persons who are too young to be married, and the proportions would vary as the number of children in a population is large or small. It is customary, therefore, to take the population above a certain age. Mayr gives the following percentages of the population of the age of 16 and over that are unmarried:

In France.....	33.1	In Portugal.....	43.0
In England and Wales	37.2	In Switzerland.....	44.0
In Italy.....	37.2	In Belgium.....	44.9
In Germany.....	42.0	In Ireland.....	45.0
In Norway and Sweden	40.0		

The small number in France is due to the peculiar distribution of population in that country; the large proportion in Ireland, to the emigration of married and marriageable persons.

The striking difference caused by emigration and immigration is brought out in the Massachusetts census of 1885, where they distinguished the native and foreign-born:

*Conjugal Condition of Persons 20 Years of Age
and Over.*

CONJUGAL CONDITION.	PERCENTAGES.					
	Males.		Females.		Aggregate.	
	Native.	Foreign.	Native.	Foreign.	Native.	Foreign.
Single	32.20	25.90	29.09	25.67	30.57	25.78
Married.....	62.19	67.92	56.16	57.97	59.02	62.58
Widowed...	5.34	6.10	14.34	16.24	10.07	11.54
Divorced....	0.25	0.06	0.41	0.11	0.33	0.09
Unknown...	0.02	0.02	0.01	0.01	0.01

None of the above figures gives us exact information as to the number of persons unable or unwilling to get married, because at the age of 16 or 20 marriage is just commencing, and many who are then unmarried marry in later life. Mayr, therefore, gives the number of those who have reached the age of 50 and are still unmarried. If a man is not married at that age it is because he is unable or unwilling. The percentage of persons among the population over 50 years of age who are not and have not been married is:

In Saxony.....	6.4	In Germany.....	10.6
“ England and Wales,	9.9	“ Italy.....	11.5
“ Prussia.....	8.4	“ Ireland.....	14.4
“ France.....	10.3	“ Bavaria.....	19.2

When the number is greater than 10 per cent it is due to some social peculiarity. The very large number in Bavaria is due to the old marriage laws. In some districts it runs as high as 23, and 26, and even 40 per cent of the population of that age. In the Palatinate, on the other hand, where there is a similar

population but where the marriage laws did not exist, the proportion is only 6 and 8 per cent.

Mayr also gives some interesting figures showing the number of persons really living in the marriage relation. For this purpose he takes the persons between the ages of 40 and 50. That is the time when most of the marriages have already taken place and when too many have not been broken by death. The following table shows the percentage of the population of that age actually living in the married state.

In Saxony.....	84.	In France.....	77.6
" Prussia.....	81.9	" Italy.....	76.9
" Germany.....	80.3	" Bavaria.....	74.5
" England and Wales	79.2	" Ireland.....	71.5

Differences in different countries are due to local causes not all explicable.

The Defective Classes.

In every community there is a number of persons who, on account of bodily or mental infirmity, do not add to the strength of the community, but are a burden. We do not mean those who are not in perfect health,—it is impossible to ascertain the number of these except from the statistics of deaths from certain diseases,—but those who are prevented by their infirmity from performing public duties or who must be supported by the community. The most general statistics we possess of these persons are the military statistics. Haushofer asserts that of all men in their 21st year 59 per cent are unfit for military duty,—22 per cent on account of under size and 37 per cent on account of disease and weak constitutions. These men are, of course, not entirely useless

to the community, but they represent a failure of effective strength.

Of mere constitutional infirmity we get no statistics. It is only where the infirmity is very marked that we can record it. The principal classes are the blind, the deaf and dumb, the insane, and the idiotic. It seems that in Europe these classes make up nearly one-half of one per cent of the population. It is difficult to give statistics of different countries that are comparable, because the rigor with which they are collected is very different, and the classification of idiots and insane is not always perfect. The latest statistics are as follows. Out of 100,000 inhabitants there are:

In	Blind.	Deaf-Mutes.	Idiots.	Insane.	Total.
Italy.....	105	74	65	99	343
Germany.....	87	96	139	88	410
Great Britain.....	98	57	129	178	462
Norway.....	136	92	119	185	532
Sweden.....	80	102	39	176	407
Belgium.....	81	43	50	92	266
France.....	83	62	114	146	405
United States.....	96	66	152	182	496

There are some national peculiarities which it is not altogether safe to insist upon because they may be due to imperfections in the statistics. Thus Norway stands out strongly with its large number of blind; Germany with the idiots; and England and the United States with the insane.

Interesting special studies may be made of these different classes of unfortunates. The males predominate over the females. In respect to age, blindness increases with age as does also insanity, while the number of deaf-mutes and of idiots decreases

with age, showing simply a higher mortality among these unfortunates than in the population at large. They are largely shut out from marriage. In Prussia, in 1880, out of 100 blind males 55 were married, widowed, or divorced, and out of 100 females 53. Of the deaf-mutes only 8.5 per cent of the males and 6 per cent of the females were married.

It is commonly said that marriage has a favorable restraining influence on insanity. For instance the statistics from Prussia give the following results as to conjugal condition of the mentally diseased (including both the insane and the idiotic.) Out of 100,000 of the population of each class there were mentally diseased:

	Males.	Females.
Among the married.....	95.	95.
“ “ single.....	332.	293.
“ “ widowed.....	321.	256.
“ “ divorced.....	1071.	1030.

It would thus appear that there is much less tendency to insanity among the married than among the single. It must be remembered in this case, as with all statistics of the influence of marriage, that marriage is itself a process of natural selection. In many cases the disease or the premonitory symptoms prevent marriage, and so these persons remain in the ranks of the single. Doubtless, the regularity and orderliness of married life may also have some restraining influence.

The fact that insanity increases with advancing age and is scarcely ever a disease of childhood warns us against the commonly received statement, that insanity is more frequent among the foreign-born, in proportion to their number, than among the native-born in the United States. It must be re-

membered that the foreign-born are almost all in adult life, while the native-born include a large proportion of children, so that the comparison is not a fair one. The only fair basis of comparison would be the proportion of insane among persons of the same age in the foreign and native-born population. The same remark applies to the blind, and also to the statistics of pauperism.

*The Movement of Population.*¹

Up to this point we have been considering the characteristics of population as it actually exists at any given moment of time. An equally important subject of observation is the changes in population, the coming and going of the population. The population of a country or of the world is not composed of the same individuals from year to year or even from day to day. It is being decreased by the death or withdrawal of certain individuals, and increased by the addition of others. It is like an army whose ranks are constantly diminished by deaths and desertions, and constantly filled up by new recruits.

Statistical observation has three questions to investigate here: (1). Is population increasing or decreasing? This is merely to establish a fact which can be established only by statistical enumeration. (2). At what rate is population increasing or decreasing? This also is merely the establishment of a fact. (3). What are the causes of the increase or the decrease? The immediate causes are, for the world at

¹For this subject see, besides the general literature, particularly Mayr, *Die Gesetzmässigkeit*, etc., William Farr, *Vital Statistics*, and Westergaard, *Die Lehre von der Mortalität und Morbidität*. For the international tables see the Italian publication, *Popolazione: Movimento dello stato civile*, 1880.

large, the relation of births and deaths to each other, and for particular countries, in addition to these, immigration and emigration.

A word may be said here in regard to the method of investigation necessary in this part of statistical work. The number and characteristics of a population may be obtained by a single census; but in studying the changes of population we must have a succession of observations at regularly recurring intervals, and, for the more important data, continued registration. It is true that by decennial or quinquennial censuses we can get at the bare fact of an increase or decrease of the population; but the reasons for the increase or decrease can not be determined. It is impossible once in ten years to ascertain all the births and deaths that have occurred during the preceding years. For this purpose we must have an official registration. So also when we try to connect the number of births and deaths with causes that may have influenced them, such as the scarcity of food,—continued observations of the price of food are necessary,

This kind of observation is more difficult than that of a mere census. In former times the church did service in this direction with its records of baptisms, marriages and burials. In modern times these have been superseded by the observations of the state, which in Europe, almost everywhere, keeps an official registration of births, deaths and marriages. The United States is singularly deficient in this respect. The federal government does not attempt any such registration for the whole country, and where the states require it, the provision is generally evaded. The result is that we have practically no

vital statistics of the United States that are of any value. Our illustrations under this head must be taken almost entirely from Europe.

Increase and Decrease of Population.

Among savage and uncivilized tribes we have remarkable examples of decrease in population; as the fading of the South Sea Islanders and the Indians of North America before the white men. But among civilized nations population is almost everywhere increasing. A remarkable exception is Ireland, where the population has steadily decreased from 8,175,124 in 1841 to 5,159,839 in 1881. The cause of this enormous decrease is emigration. In Alsace-Lorraine, after the German annexation of 1871, there was also a decrease from emigration. In some portions of France during the years 1872 to 1876, there was an absolute decrease in population due to decline in the number of marriages and the excess of deaths over births. The rate of increase varies widely in different countries, and in the same country at different periods. It is commonly expressed by the relation of the annual increase to 1,000 of the whole population, and the rapidity of increase is further measured by calculating the length of time it will take the population at that rate of increase to double its number.¹

'DOUBLING PERIOD.

Annual Increase.	Doubling Period.	Annual Increase.	Doubling Period.	Annual Increase.	Doubling Period.
1 per 1,000	695 years.	8 per 1,000	87 years.	15 per 1,000	46.4 years.
2 "	348 "	9 "	74 "	20 "	34.8 "
3 "	232 "	10 "	69.6 "	25 "	28.07 "
4 "	174 "	11 "	63.2 "	30 "	23.2 "
5 "	139 "	12 "	58 "	40 "	17.6 "
6 "	116 "	13 "	53.5 "		
7 "	95 "	14 "	49.7 "		

The following table shows the rate of increase for long periods of time :

Country.	Period.	Annual Increase.
Saxony	1816-80	13.3 per 1,000
England and Wales.....	1831-81	12.6 "
Prussia	1816-80	12.1 "
Norway	1835-75	10.5 "
Denmark	1834-80	10.1 "
Germany	1816-80	9.4 "
Sweden	1830-79	9.4 "
Scotland	1831-81	9.1 "
Holland	1839-79	8.7 "
Austria	1850-80	7.7 "
Great Britain and Ireland.....	1831-81	7.3 "
Belgium	1846-76	6.9 "
Italy.....	1833-78	5.8 "
Austria-Hungary.....	1850-80	6.7 "
Switzerland.....	1837-79	5.9 "
Bavaria.....	1816-80	5.6 "
Hungary.....	1850-80	5.6 "
France	1821-76	3.9 "
Ireland (decrease).....	1831-81	9.3 "

It is noticeable that all the countries in the first half of the table, where the increase is largest, are, with the possible exception of Scotland, of pure Germanic blood. The United States shows from the beginning of its censuses a rate of increase greater than any in this table, running up to thirty pro mille and doubling once in twenty-three years ; but the causes of that increase have been so exceptional that it is scarcely profitable to compare it with European countries.

Births.

The first thing in getting at the causes of an increase or decrease of population is the birth-rate. That is expressed by the proportion of the annual number of births to 1,000 of the entire population,

and for the countries of Europe is shown in the following table. For convenience the death-rate and marriage-rate are shown at the same time :

Birth, Death and Marriage Rate per 1000 Inhabitants.
(Still-born excluded.)

Country.	Births. (Annual.)	Deaths. (Annual.)	Marriages. (Annual.)
Italy (1865-1878).....	37. per 1,000.	29.9 per 1,000.	7.6 per 1,000.
France (1865-1877)...	25.8 "	24. "	8. "
Eng. & Wales (1865-'78)	35.6 "	22. "	8.4 "
Scotland (1865-'78)...	35.2 "	22.1 "	7.2 "
Ireland (1865-'78)...	26.7 "	17.2 "	5.1 "
Germany (1872-'78)...	39.8 "	27.1 "	9.5 "
Prussia (1865-'78)...	38.7 "	27.2 "	8.9 "
Bavaria (1865-'78)...	39.4 "	30.9 "	9.2 "
Saxony (1865-'78)...	41.7 "	28.7 "	9.3 "
Württemb'g (1865-78)	43.4 "	31.6 "	9.2 "
Austria (1865-'78)...	38.8 "	31.8 "	8.7 "
Hungary (1865-'77)...	41.8 "	38. "	10.5 "
Croatia & Slavonia } (1870-'78)	44.1 "	43.7 "
Switzerland (1870-'78)	30.8 "	23.8 "	7.6 "
Sweden (1865-'78)...	30.4 "	19.2 "	6.6 "
Norway (1865-'78)...	30.5 "	17.3 "	7. "
Belgium (1865-'78)...	32.1 "	23.2 "	7.5 "
Spain (1865-'70).....	35.7 "	31.2 "	7.4 "
Servia (1865-'78)....	43. "	32.1 "	11.3 "
Russia (Europe) } (1865-'77)	49.5 "	36.7 "

At one end of the scale stand the Slavonic nations, Russia, Croatia and Slavonia, and Servia; at the other end stand France and Ireland. The small birth-rate is characteristic of France, and is the cause of the slow increase in population; in Ireland, it is due to exceptional causes such as the emigration of persons of marriageable age. The pure Germanic countries generally have a high birth-rate, and in South Germany, particularly Bavaria, the rate is

very high indeed. England has a moderate birth-rate which, in connection with the moderate death-rate, shows a favorable condition of things.

Influences on Births.

Many attempts have been made to trace the influences which determine the birth-rate, but they have not been very successful. Climate and geographical position seem to have no appreciable influence. We find countries widely separated, such as Spain and Scotland, having the same birth-rate; while countries that are near together, like Bavaria and Switzerland, have widely different birth-rates. The seasons seem to have some influence, for we find the largest number of births almost invariably in the month of February,—corresponding to conceptions in the spring time, the month of May. Possibly there may be some physiological influence here which is partly obscured by social causes. A second increase over the usual monthly average of births is found in September, corresponding to conceptions in December. This is probably due to the crowding of marriages into the period after the harvest and during the festival time. In Catholic countries, it is found that births due to conceptions falling in the carnival time are numerous, owing to the crowding of marriages into the period before Lent. Density of population is often thought to influence the birth-rate; but it cannot be proven. Belgium, which has the densest population of any country in Europe, has a low birth-rate; while Saxony, which has also a dense population, has a very high birth-rate. Even the difference between city and country is very slight. In Prussia, for

instance, during the decade 1872-1881 the average birth-rate in the cities was 40.9 per 1000 inhabitants, and in the country, 41.2 per 1000.

It is pretty clearly established that dearth of food, hard times and wars have an influence in depressing the birth-rate. In Germany, the years 1847 and 1854, following the scarcity years 1846 and 1853, had a very low number of births. Those following the panic of 1873 showed a gradually decreasing birth-rate in most of the countries of Europe, due doubtless to the less number of marriages. The effect of the war of 1870-71 was noticed in Germany. In Prussia the average birth-rate for the years 1865 to 1878 was 37.8 pro mille. For the year 1871 it was only 33.7 pro mille. Immediately after the war there was a revival of the birth-rate, (in 1872 it was 39.7), making good the depression of the previous year.

Such are the influences which we can trace only vaguely, affecting the birth-rate. Statistics discover certain other facts connected with the birth-rate which are of interest to social science. These are the relation of the sexes, *i. e.*, the number of boys born compared with the number of girls; the number of still-born; the number of illegitimates; and the number at a birth.

Proportion of the Sexes at Birth.

This is the discovery of a purely physical law over which we have no control, and the reason for which we do not understand. It is an illustration of the value of the simplest form of the statistical method. From personal observation we could determine nothing about the relative number of boys and

girls born. In one family the children are all girls, in another all boys, in most they are partly boys and partly girls. Reasoning *a priori*, or from general observation of a great number of families we would probably say that in the long run and on the average there would be the same number of boys as girls.

Statistical observation shows, that, in the countries of Europe at least, there is a constant excess of boys. There are from 102 to 106 boys born to every 100 girls. In Italy the proportion was 107; in Austria, 106; in France, Germany, Prussia, Bavaria, Saxony, Hungary, Switzerland, Belgium, Holland, Sweden, Norway, Denmark, and Finland it was 105; in England and Wales, and Württemberg it was 104. In Greece and Roumania it ran up to the extraordinary number of 111, but the statistics cover only a few years and are not very reliable. Most of the above figures are the average for the years 1865 to 1877, and are exclusive of the still-born. If we included the still-born the excess of boys would be greater, for among these the excess is much greater than among the living. In Italy (1875), for instance, the number of boys among the still-born was 140 to 100 girls; in Prussia (1881), 128. The reason for this excess of boys over girls is entirely unknown. There are many theories as to the determination of sex, but none of them have been accepted by medical science.

The Still-Born.

A certain number of children do not survive the dangers of the act of birth. They constitute from three to four per cent of the total number of births. The number is uncertain owing to differences in the laws of different countries and the customs and the

sentiment of the people. In catholic countries, for instance, there is always a strong desire that the child shall live until after baptism, so that there is often doubtless collusion on the part of physician and parents to declare that a child was living when it was born, when in fact it was still-born. By the Code Napoleon births must be registered within three days, and children dying before registration are classed with the still-born. This increases the number of still-born in France and in those parts of Germany where the Code Napoleon prevails. Thus in the Palatinate, a protestant country with the French law, the percentage of still-born is 4.8; in Lower Bavaria, a catholic country with common law, the percentage is only 1.7

The Illegitimates.

The number of illegitimates is to a certain extent indicative of the morality of the community and so has an interest for social science. It is only partly so indicative, for the illegitimacy may be due to marriage laws such as prevailed in Bavaria, and which caused a large number of illegitimates without influencing the real morality of the people to any great extent. This is shown by the fact that as soon as the laws were abolished the number of illegitimates decreased. Thus in Bavaria the number was, in 1865, 22.47 per cent, in 1877, only 16.47 per cent of the births. The influence of the old laws still remains, but is steadily diminishing. The usual number of illegitimates in the countries of Europe is about seven per cent. The number in large cities is greater than in the country. In Prussia, in 1880, the percentage of illegitimate births

for the whole country was only 7.9; in Berlin it was 13.7 per cent; in Breslau, 15.9; in Königsberg, 18.9; in Danzig, 17; in Frankfort, 10; and in Bonn, 22 per cent. There were many more among protestants than among catholics. In Prussia, (1875-1881), the number with evangelical protestant mothers was 8.85 per cent; with catholic mothers, 5.64 per cent; with Jewish mothers, 2.73 per cent.

Multiple-Births.

The number of children at a birth is generally but one. Cases of twins or more occur in about one or two cases in a hundred births. As many as five have been born at a time. In Prussia, three such cases have been recorded during this century. The number of still-born is much greater in the case of two or more at a birth than in single births.

Marriages.

Closely connected with births is marriages; for the number of births is largely dependent on the number of marriages. Here, however, we stumble on the question of free-will,—not in so startling a form as when we come to the so-called moral and immoral actions of men, but in a similar form. In fact, it is easy to come to an agreement here, while further on it is not so easy. In the individual case, marriage is a free action,—in the choice of the person, of the time and place, etc. One can easily grant, however, that other influences might be so powerful as to override the desire of the individual, and determine the number of marriages from year to year.

These influences would be of two kinds: (1) prohibitory laws, making marriage more difficult by

requiring economic resources, or settled position, or the performance of certain public duties such as military service as a previous condition to marriage; or (2) natural influences, making the problem of existence harder and, in the case of prudent men, discouraging marriage on account of uncertain prospects for wife and child. When we consider these influences and those grouping themselves about them, such as the desire to gratify the sexual passion, to have a home and domestic comforts, the influence of law, religion and morality in restraining the indulgence of passion outside of wedlock, we should probably reach the conclusion that the power of free-will in this matter is very small indeed.

Statistical science supports this view. There is no free-will in the sense of individual caprice or power to do as one pleases. The act of marriage is controlled by great general causes which influence the individual even when he may not be aware of it. This is shown by the fact that when we have like causes we have like effects, and when we have unlike causes we have unlike effects. Mayr gives the following example of the influence of bad times in Bavaria: The years 1840 to 1845 were years of quiet prosperity with no great increase of population and no emigration to amount to anything. The number of marriages during those years was successively, 29,500, 29,463, 29,356, 29,490, and 29,373. What an astonishing regularity! One is tempted to say that the number of marriages is fixed by natural law in the same sense that the excess of boys over girls born is fixed. In 1846-7 (a bad year), the number sank to 28,331,

and in 1853-4 to 26,939, although in the intervening years it had risen to 30,000. After 1862, with the modification of the marriage laws, the number rose to 40,000 and in 1869, with the entire abolition of those laws, to nearly 60,000. That number was exceptional. The German-French war brought it down to 40,707 in 1871. The cessation of the war restored it to 52,045. Bavaria shows these influences admirably because the occurrences have been so well-defined. Hermann, in view of these facts, laid down the following rule: "The number of marriages in any period expresses the expectation of economic prosperity prevailing at that time, and expresses this the more plainly, the greater the economic freedom of the country."

The Marriage Rate.

The frequency of marriage is expressed by a marriage-rate which is the pro mille proportion of the number of marriages per annum to the entire population of the country. The marriage-rate for different countries is shown in the table on page 47. It is generally high where the birth-rate is high, but is not necessarily low where the birth-rate is low. A curious example of this is the case of France, where the marriage-rate is as high as in most countries, although the birth-rate is the lowest of all Europe. The marriage-rate is higher in cities than in the country. It varies at different seasons of the year, but the time for the celebration of marriage is so much influenced by custom and religious observations that no law is discoverable.

Brides and Bridegrooms..

Marriages occur most frequently between bachelors and maids; but widowers have a better chance of marrying a second time than do widows. In Prussia, for instance, from 1867 to 1881, out of 1000 men that married, 853.7 were bachelors, 141.4 were widowers, and 4.9 divorced men. Out of 1000 women that were married, 906.6 were maids, 88.4 were widows, and 5.0 were divorced women. The bridegrooms are everywhere older than the brides; but there are certain peculiarities which are difficult to understand. In Italy 26 per cent, and in France 27 per cent of the bridegrooms are below the age of 25. This is the customary proportion. In England and Wales, on the other hand, 53 per cent of the bridegrooms are below the age of 25. The brides in England do not seem to be very much younger than on the continent. In Italy 60 per cent of the brides are below 25 years, in France 58 per cent, and in England 64 per cent are below that age. Englishmen get married younger and take women nearer their own age than is the custom on the continent.

Intermarriage of Different Religious Confessions and Races.

Where different religious confessions are represented in a population people generally marry persons of the same faith. In Prussia, in 92.8 per cent of the marriages both parties are of the same religion. The catholics seem to be the most liberal in this respect. Of evangelical bridegrooms 95 per cent married evangelical wives, 4.7 per cent catholic wives, and a small number married Jewesses. Of

Jewish bridegrooms 95.2 per cent married Jewesses, 3.9 per cent evangelical women, and 0.8 per cent catholic women. Of catholic bridegrooms 88.4 per cent married catholics, 11.4 per cent evangelical women, a small number, Jewesses.

In the United States we have the interesting problem whether the different nationalities which immigration has brought here will amalgamate by marriage so as to form a new race. This question has been as yet but partly answered. The only statistics we have are those giving the place of birth of the parents of persons when those parents were one or both of foreign birth. The number having both parents of the same nationality, although they themselves may have been born in this country, is very large, for many of the marriages must have been consummated before the parents came to this country. It appears that in the city of New York, of 10,000 persons who had Irish fathers, 9,441 had Irish mothers, 393 had mothers born in the United States, 13 had German mothers, 119 mothers born in Great Britain, and 22 British-American mothers. Of 10,000 persons in the city of New York having German fathers, 9,295 had German mothers, 482 had native-born mothers, 77 had Irish mothers, 37 mothers born in Great Britain, and 6 British-American mothers. Where the nationality is represented it tends to intermarry. Where it is not strongly represented it is compelled to marry with persons of native birth or of a different foreign nationality. Thus in Rhode Island where Germans are not numerous, of 10,000 persons having German fathers only 7,594 had German mothers, 993 had native-born mothers, 602 Irish mothers, 386 mothers

born in Great Britain, etc. There is some intermixture of blood going on in this country owing to intermarriage, but it is not very great. The statistics of Massachusetts for 1885 confirm the observations of the tenth census of the United States.

Fruitfulness of Marriage.

The fruitfulness of marriage is commonly measured by dividing the number of births in a year by the number of marriages consummated that year. It is obvious that this is only an indirect method of ascertaining that fruitfulness, for the children of any year are not borne by the women married that year. It will serve, however, as a rough measure for international comparison. In most countries there are four children to the marriage. In France there are only three.

In Massachusetts, the direct question was asked of all married women as to the number of children they had had and the number still living. The average number was 4.11 for each married woman, of which 2.83 were living and 1.28 were dead. Native-born mothers had had 3.37 children, of which 2.41 were living and 0.96 were dead. Foreign-born mothers had had 5.22 children, of which 3.46 were living and 1.76 were dead. It must be observed that this average is not indicative of the fruitfulness of the women of Massachusetts, for many of these women are newly married. Neither is it indicative of the comparative fruitfulness of native and foreign-born women, for there may be a larger proportion of newly married women among the one class than among the other. We have no general statistics that will show the average fruitfulness of women

of any country, that is, the number of children they will bear before they finish child-bearing.

In Prussia they have collected curious statistics showing the fruitfulness of marriage when the parents are of the same or of different religious confessions. When both parents are catholic the number of children is 5.21; both evangelical, 4.30; both Jewish, 4.41; evangelical and catholic, 3.23; christian and Jewish 1.60. The probable explanation of the low fruitfulness of the mixed marriages is that such marriages are apt to be contracted from motives of expediency, rather than natural affection.

Duration of Marriage.

Marriage is generally broken by the death of one of the parties. The average length of marriage can be ascertained only by the statistics of the deaths of married persons. In Prussia the married persons who died during the years 1875-81 had lived together an average of 22.4 years. When the man died first, the length was 23.2 years; when the woman died first, the length was only 21.5 years. This is due to the fact that the greatest danger to the woman's life comes with child-bearing, and hence the marriages that are broken by the death of the woman are apt to be of short duration. Marriages that have stood less than five years are broken more frequently by the death of the woman than of the man; those which have stood more than five and less than twenty-five years, much more frequently by the death of the man; after twenty-five years, by the death of the man rather than of the woman, but not so frequently. Out of 1,000 marria-

ges in Prussia broken by death, 562.9 were broken by the death of the man, and 437.1 by the death of the woman. This is explained, of course, by the fact that the husbands are older than the wives and hence die first, as well as by the greater general mortality among men.

Deaths and the Death-Rate.

The statistics of deaths are taken with a good deal of care and are of very great interest and importance. It is often assumed that the death-rate in itself is the surest indication of the health and well-being of the community. It must, however, be used with a great deal of care and with exact knowledge of what it does and does not show. The matter of real interest is the cause of the increased or decreased death-rate in each community, and it is only when we reach underneath the figures and examine these causes that we obtain results of any social value.

We start out with the annual death-rate, which is the number of deaths per annum for each one thousand of the population. The death-rate for different countries for a long series of years is shown in the table on page 47. It is closely connected with the birth-rate. Almost invariably where there is an excessive birth-rate, as in Russia, there is a high death-rate. The primary cause of this is the great mortality among infants and children. A high birth-rate also is characteristic of half civilized countries where the sanitary conditions are bad and the death-rate is thus increased. The example of England shows that it is possible to have a reasonably

large number of births and a comparatively small death-rate. Where the birth-rate is very small, as in France, the death-rate is small.

The death-rate varies at different ages, being very heavy among infants, low during middle life and increasing with old age. The general death-rate depends, therefore, very largely on the proportions of the different age-classes represented in the population. It is thus by itself utterly untrustworthy as indicative of the health of the community, and the common practice of comparing the death-rates of different cities has no sense.¹ For instance, a sudden increase in the number of births would increase the death-rate, because the addition of a number of infants to the population would have a greater effect on the deaths than on the total population, and would thus increase the death-rate, although on the whole it might have been a very healthy year. Emigration, by taking out of a country the strongest and healthiest individuals might increase the death-rate, although the sanitary condition of the country was precisely what it was before. Immigration, by adding to the population persons in the healthiest period of life might decrease the death-rate, indicating no change in the condition of the country or the habits of the people, but simply in the constituent elements of the population. The final result might even be unfavorable to the health of the community by overcrowding and competition.

Infant Mortality.

One of the saddest things in the statistics of deaths is the enormous mortality among children. From

¹ English statisticians defend it. See Farr, *Vital Statistics*, p. 111.

25 to 40 per cent of all the children brought into the world die before they have completed their fifth year. The number varies for different countries: in Italy it is 39.4 per cent; in Austria, 38.9 per cent; in Prussia, 33.4 per cent; in France, 24.9 per cent; in England and Wales, 25.3 per cent. In some parts of Germany this infant mortality is frightful. In some counties in Bavaria forty per cent of all the children born, die the first year. The cause of this enormous mortality is artificial nourishment and insufficient care.

The infant mortality in cities is greater than in the country owing to the bad sanitary arrangements, especially the crowding in tenement houses. In England it was, during the first twelve months, 14.9 per cent; in the 51 country districts, 10.3 per cent; in Liverpool, 23.4 per cent. In the city of Berlin 32 per cent of the children die during the first year.

External Influences on the Death-Rate.

No direct and consistent influence of climate and geographical position is traceable. The highest customary death-rate is in some Russian provinces, where it runs as high as 50 pro mille. Quetelet tried to divide Europe into three zones, and to show that the mortality was greatest in the southern, less in the middle, and least in the northern. Some trace of such an arrangement may be seen in the table of death-rates, but the facts do not always correspond with the law. In fact, climate seems to have a decisive influence only on strangers. The attempts of Europeans to settle in the tropics have been in vain.

Statistics have also brought out (says Haushofer) the curious fact that there is no such thing as ac-

climation by long residence. The British army in India, it has been found by experience, must be changed once in three years, for the mortality increases from year to year instead of decreasing by continuous residence. In Ceylon, out of a thousand men, 44 died the first year, 48 the second, and 49 the third. In Guiana the mortality was 77 the first year, and then steadily increased up to the tenth year, when it was 140. Algeria has cost France 150,000 men, of whom only 4,000 have been killed by the enemy; the marriage-rate and the birth-rate are both favorable among the French settlers, but the death-rate is enormous. Children of white persons, born in Eastern countries, cannot be brought up there but must be sent home.

Variations in the temperature have great influence on the death-rate. It is the extremes that kill—in cold climates the extremes of cold, and in warm climates the extremes of heat. The effect on the population is largely influenced by the age of the persons. In infancy and childhood the summer months are the most fatal. As individuals advance in age the influence of the climate becomes less and less, and the mortality is no greater in summer than in winter. As old age approaches, the cold weather kills and the winter is the fatal time.

The death-rate is generally higher in the city than in the country:

	Men.	Women.
The death-rate in 51 country districts in England was	17.56	16.23
“ “ “ England and Wales at large	23.61	21.28
“ “ “ London.....	26.55	22.34
“ “ “ Manchester Districts	35.38	30.46
“ “ “ Liverpool Districts.....	40.96	36.26

In Germany the difference is not so great. In Prussia, for instance, the average death-rate for the whole

country in 1880 was 27.3 pro mille; in Breslau it was 34.3, in Berlin 31.1, in Königsberg 31.1, in Cologne 30.9, in Hanover 22.6, in Frankfort-on-the-Main 19.7 pro mille. In some of the cities it was more favorable than in the country at large. The city in fact has some advantages over the country. Its population is generally in the stronger periods of life, or at least those periods are largely represented owing to the migration of persons from the country. Medical help is easier to get; hospital service is free; charity is more easily obtained in case of want; among many classes the houses are better and the food more varied and better cooked. To offset these advantages we have the immigration of criminals and vagabonds, the wretched condition of the tenement houses, the temptations to vice, debauchery and crime.

Scarcity of food, hard times, wars, etc., have direct influence on the death-rate, as was seen in the increased number of deaths after the years 1846 in Ireland, 1853 in Germany, 1870-71 in France. It is not easy to measure the extent of such influences, because the effect on the death-rate often comes some time after the crisis has passed, in the shape of disease due to insufficient nourishment, wounds, and exposure. The only method seems to be to take the dear or bad years and watch the death-rate of that and the following years. It will generally be found that the death-rate begins to increase the year after the bad times,—sometimes during the same year. It is said that children do not suffer so much from the scarcity of food as the grown persons. The older look out for the younger, and less is saved by economizing on the child's food than

on the adult's. At first, the men show the effects of scarcity more than the women because they are working, but later the women show it more.¹

Deaths from Violence, Accident, and Disease.

The number of deaths from violence and accident is always considerable, and varies from country to country according to the nature of the occupations of the inhabitants. From 1865 to 1877 the number of such deaths out of 100 deaths from all causes was in Italy 0.9, in England and Wales 3.44, in Prussia 2.26, in Bavaria 1.49, in Switzerland 3.77, in Norway 3.91, in Sweden 3.20. They occur more frequently to men than to women, because the former are engaged in the dangerous employments, and more frequently to adults than to children for the same reason. Drowning is the most frequent of all accidents, and for that reason there are commonly more accidents in summer than in winter, especially among the agricultural population who are engaged in out-door occupations at that season.

Deaths according to disease form a most important branch of medical statistics, but it is impossible for us to go into the subject here. It is in a very confused and unsatisfactory state owing to the lack of any uniform classification in different countries. The statistical congress of 1853 tried to remedy this difficulty by recommending a uniform classification, but it was not adopted and the matter is in as bad condition as ever. Then there is nowhere a compulsory *post mortem* examination,

¹ Weisz. Einfluss von theueren und billigen Zeiten auf die Sterblichkeit.

so that in many cases the real cause of death is uncertain, and the cause returned is simply that which the physician was treating as the disease. When one considers the extreme importance of this subject to the community, one would think that there would be established everywhere a *post mortem* examination by disinterested officers, to determine the real disease and its nature. The investigation might cover many facts, such as the age, sex, conjugal condition and occupation of the deceased, the place where the disease was most prevalent, seaside or mountain, source of water supply, time of year, time of the recovery and convalescence, fatality, etc. Scarcely any of these things are now ascertained, although in England and Germany the beginnings of such investigations have been made in the case of certain diseases.¹

Social Influences on the Death-Rate.

It is often said that marriage has a favorable influence on the death-rate, and that the married have a better chance of living than the single. The influence cannot always be distinctly traced. Marriage is in itself a process of natural selection, and we should expect that its influence would be steadying and in the direction of good habits and careful living. The statistics for the city of Berlin, which have been collected with considerable care, do show for the most part a less mortality among the married than among the single men. For the women, the increased care brought by marriage and the perils of childbirth seem to offset the favorable

¹See Farr, *Vital Statistics*, p. 209.

effect of married life, so that at many ages the married have a greater death-rate than the single.

There is no doubt that vice and crime add to the mortality. It is possible to trace the influence of morality on the death-rate only indirectly. One method is by the statistics of the deaths among illegitimate children. The vice shows itself in such neglect of the offspring that the mortality among them is sometimes frightful, and it is always in excess of that among the legitimates. In Prussia, in 1880, of the legitimate children 22.6 per cent died during the first year, of the illegitimate 38.8 per cent. In the large cities 28.6 per cent of the legitimates and 50.0 per cent of the illegitimates died during the first year. After that period it is difficult to trace the illegitimates except in the statistics of crime.

The social position of some classes, implying a better economic condition, renders the death-rate less among them than among the lower classes; but this is only a general statement which it is impossible to verify by exact statistics, because of the difficulty of classifying deaths according to the social position of the deceased. In Germany they have, in one or two cases, classified the deaths according to the quarter of the city and it has been found, of course, that the higher death-rate is in the quarters inhabited by the lower classes. But it is impossible to get clear-cut divisions of this sort and the higher mortality is due to the sanitary condition of the places inhabited by the lower classes.

Mortality in Occupations.

In the same general direction are the attempts to constitute by the statistics of mortality a greater or

less healthfulness of occupations. The trouble is that it may be not the occupation itself but other circumstances that influence the mortality. An occupation may be overcrowded, and the wages low and the economic condition of the persons pursuing it bad on that account. Or it may be one requiring great strength, and thus only the healthy and strong go into it. Or it may be one which the weak and the feeble may learn, and thus an undue number of that class go into it. In those cases the mortality would be affected by such a fact more than by the character of the occupation itself.

We have some interesting statistics of this sort for England, which doubtless point in a general way to the healthfulness or unhealthfulness of different employments.¹ The basis is the report of the registrar-general for 1875. The statistics cover 62 different occupations. The method is to compare the mortality of men at different ages in any one occupation with the general mortality of males for all England, and the mortality in all the 62 occupations. The table for comparison is as follows :

				All England. Pro Mille.	62 Occupations. Pro Mille.
At the age of 15 to 20 years the mortality is				6.3	4.2
"	"	20 " 25	"	8.6	8.3
"	"	25 " 35	"	9.8	9.7
"	"	35 " 45	"	13.0	13.3
"	"	45 " 55	"	18.5	19.6
"	"	55 " 65	"	32.2	35.0
"	"	65 " 75	"	66.8	75.6
"	"	75 and over	"	165.8	192.2

At first, the mortality in the 62 occupations seems to be less than in the whole population,—due proba-

¹Westergaard, *Die Lehre von der Mortalität and Morbidität*.
Farr, *Vital Statistics*.

bly to the fact that in early life the occupation has no great influence and perhaps is not always given. At the age of 35 the mortality increases in the occupations, and remains above the average for the whole population.

When, now, the mortality in any particular occupation is greater than that for all England, it is said to be unfavorable. When, in the later years, it is greater than that for the 62 occupations, it is still more so. When, on the other hand, the mortality is less than that for all England, it is said to be favorable.

The results for different occupations are very general. They can be but briefly indicated here. Commercial clerks:—mortality is from 10 to 12 per cent greater than it should be, and increases with age. The reasons are obvious; they live mostly in cities, work in confined posture, are not particularly well paid, etc. The clergy in England have a favorable mortality,—only 71 per cent of that of all England, and 66 per cent of that in the 62 occupations. They live in the country, have a quiet life, an assured income even if small, little anxiety for the future. Physicians:—the mortality is 6 per cent greater than that of all England, and about the same as that of the 62 occupations notwithstanding the fact that these contain so many men of inferior social and economic condition. It is due to the exposure and irregular life. Lawyers in England are divided into barristers and attorneys; the former show a very favorable mortality, only about 62 per cent of that of all England, while among the latter it is much less favorable, being about the same as that of all England. School teachers have about the same

mortality as the whole population, but it tends to increase with age so that the occupation cannot be said to be a healthful one. In occupations carried on in the country—farmers and graziers, agricultural laborers, navvies, quarrymen, brick-makers, etc., the mortality is favorable, only from 62 to 89 per cent of all England. Railroad men, seamen, miners, glass blowers, potters, plumbers, painters and glaziers, all have unfavorable mortality on account of the danger of accident, poisoning, etc., accompanying the occupation. The tailors have a great mortality, owing to the confined posture and the apprenticing of weak boys to the trade. Textile factory operatives show a somewhat greater mortality than that of the 62 occupations. The handicrafts such as cabinet-making, blacksmithing, etc., are generally favorable. The mortality among the military during peace is less than among the whole population. In war it is naturally greater. The losses of war fall more heavily on the officers than on the privates, on the staff than on the officers of the line, on the infantry than on the cavalry.

. *The Average Length of Life.*¹

One of the most important facts to learn about population is the length of life of the individuals composing it. The average duration and the expectation of life have important practical uses in calculating insurance tables, annuities, value of incomes, inheritances, pensions, etc. They have even greater

¹The next four paragraphs are principally on the basis of Mayr, *Die Gesetz mässigkeit*, etc., and the *Preussische Zeitschrift*, 1882. See also Farr, *Vital Statistics*.

sociological importance as measuring the economic and social prosperity of the people. In an economic view especially, they are of interest because a long average length of life means physical power and ability to contribute to the material resources of the community. Human life is divided into two periods, the unproductive and the productive. The first is necessary and must precede the second and its cost be borne by the second. In old age there also comes a period of partial or entire unproductiveness. The shorter the second period compared with the first and third, the greater the burden on the community. Dieterici calculated that the sum total of the ages of the Prussian population in 1855 was 444,281,631 years and that of these no less than 210,792,890 fell in the unproductive periods. That left 233,488,741 productive years which were to gain support for themselves and the unproductive years. If now the average length of life were reduced, it would reduce the total number of years which had to be supported, but it would reduce in still greater proportion the number of years of the productive persons. In short, the less the average length of life the harder for the population in each generation to pay for the cost of bringing itself into the world. So also, from the social point of view, long life generally means good customs, temperance, freedom from vice, etc.

There are a number of other figures which are often confused with the average length of life, or which are supposed to show the same thing. As has been already remarked, the death-rate is no indication of the general prosperity of the community; it shows nothing as to the average length of life,

although it might be supposed that a high death-rate would indicate a low average length of life. A high death-rate may be due, however, to altogether peculiar or exceptional causes, such as a high birth-rate or a large infant mortality, so that when the danger of infancy is once passed the population may be long-lived.

The Average Age of the Living.

This is obtained by adding together the ages of all the members of the community and dividing the sum by the number of persons. The average age of the living is: in England 26.4 years, in Prussia 27.50, in Denmark 27.85, in Sweden 27.66, in Belgium 28.63, in France 31.06 years. This figure shows nothing as to the relative length of life in different countries, because it is subject to peculiar circumstances. Where population is increasing, as in England, it is lower than where, as in France, population is nearly stationary, because the proportionate number of children is larger. So where a single generation started with a small number of births, or, from some cause or other, has had its numbers decreased, as that generation advances in life it contributes less than it ought to the number of persons living. For instance, the persons who were engaged in our civil war were from twenty to forty years of age. Their number was decreased. Those generations are now from forty-five to sixty-five years of age, and those ages are less heavily represented in the population than they should be, and the average age of the living is brought down by a purely accidental circumstance which happened a quarter of a century ago, and which has nothing

to do with the length of life at the present time. In Ireland, the enormous emigration forty years ago must make the number of persons from sixty to seventy years of age small, and thus bring down the average age of the living. Immigration, if of persons in the lower age periods, would have the same effect, while if of persons of advanced age or if the immigrants had been in the country a sufficient length of time, would have precisely the opposite effect.

The Average Age of the Dying.

This figure labors under the same difficulties as the average age of the living. It is obtained by taking the sum total of the ages of the persons dying in any one year and dividing it by the number of deaths. In Prussia, it was 31.10 years, in England 29.4, in Denmark 27.85, in Sweden 27.66, in Belgium 38.35, in France 40.36 years. Where there is a large number of births there is a large infant mortality, and the average age of the dying is reduced. Engel shows that in Prussia it has absolutely nothing to do with the general prosperity of the community. 1829 was a hard, cold year, but the average age of the dying was 31.31 years, the cold being fatal to the old people; 1847 was a scarcity year, and it was 28.29 years; 1851 was a good year, and it was 25.60 years.

Life or Mortality Tables.

The real average length of life can be obtained only by a combination of the number of the population, with their ages, and the number of deaths, with the ages. There are then two methods by which life

tables may be constructed, showing the average length of life and the expectation of life at each age. The first and theoretically the only correct method is the direct method. It consists in the observation of the number of births in any one year, and the exact registration of these persons as they die, until they are all dead. Take the total number of years lived by these persons and divide their sum by the total number of persons, and you will have the average length of life. Do this for a successive number of generations, and you will have the average length of life in that community. Hermann, in Bavaria, actually began such tables, and carried them on for forty years. The method is, however, impracticable for the following reasons: The observations must stretch over at least a hundred years before you have any life table. It is impossible to register all the deaths during so long a period. Some emigrate and thus escape the registration. When the list is complete after the lapse of a hundred years, the circumstances under which the population is living may have changed so much that the average is no longer of any use.

The second method is indirect, and consists in simply taking the population as it stands, and the number of deaths, and constructing an artificial table which will account for that number of deaths at each age. To do this it is necessary to have an exact registration of the number of persons dying and their ages, and an exact census of the people by ages, and it is desirable to have also a registration of the births, in order to control the ages and the number of the population. Then we take the number of persons of each age and the number of persons

of that age who died during the year, and calculate the death-rate. For instance, the death-rate in the accompanying table during the first year is 228.4 pro mille, at the age of ten years it is 5.5 pro mille. With this death-rate an ideal table is constructed, starting with 100,000 persons and having them die off according to the successive death-rates. Of course any single table of this sort may be vitiated by exceptional circumstances. If, for instance, the death-rate for persons of the age of twenty-one has been made abnormally great by a war, it would affect the table for all the remaining years. It is necessary to control this method by constructing tables on the basis of the censuses of different years, so that any exceptional influence will fall at a different place in the table; then we can take these tables and calculate the real death-rate at each age. The Prussian table (opposite) is on the basis of a comparison of more than four and a quarter million deaths, occurring during the years 1867, 1868, 1872, 1875, 1876 and 1877, with the population of those years.

The death-rate shows the probability of death at any age. During the first year it is 228 out of 1,000 or .2284; at the age of five years it is .0055. The probability of life at any age (not shown in the table) is simply the complement of this. At birth the probability of living through the year is .7716; at the age of five, it is .9945; at the age of one hundred it is .5185.

Mortality Table—Prussia. (men.)

AGE.	NUMBER OF LIVING.	DEATH-RATE.	PROBABLE AFTER-LIFE.	MEAN AFTER-LIFE.
	Of 100,000 born living—there survived the fol- lowing age.	Of 1,000 in each age—there died during the next year.	Of the survivors at each age the half died in— years.	The survivors of each age lived still—years.
0	100,000	228.4	37.2	35.3
1 yr.	77,154	75.9	50.9	44.7
2 yrs.	71,297	39.4	52.9	47.4
3 "	68,483	26.3	53.3	48.3
4 "	66,681	18.7	53.2	48.6
5 "	65,433	14.2	52.7	48.5
6 "	64,503	11.5	52.1	48.2
7 "	63,751	9.3	51.5	47.8
8 "	63,158	7.4	50.8	47.2
9 "	62,688	6.2	50.0	46.6
10 "	62,296	5.5	49.1	45.9
20 "	59,123	7.6	40.5	38.0
30 "	54,041	9.7	32.6	31.1
31 "	53,514	9.9	31.9	30.4
32 "	52,982	10.1	31.1	29.7
33 "	52,446	10.5	30.3	29.0
34 "	51,891	11.0	29.5	28.3
35 "	51,318	11.5	28.8	27.7
36 "	50,725	12.0	28.0	27.0
37 "	50,113	12.6	27.2	26.3
38 "	49,481	13.1	26.5	25.6
39 "	48,829	13.7	25.7	25.0
40 "	48,157	14.3	25.0	24.3
50 "	40,306	22.2	17.9	18.0
60 "	30,159	38.6	11.7	12.4
70 "	17,337	79.0	6.7	7.7
80 "	5,361	157.1	3.7	4.6
90 "	569	253.6	2.3	3.0
100 "	9	481.5	1.1	1.4

We have thus far constructed only a death table. From this we calculate the Probable After-Life by following down the death table until one-half of the people are dead. In the table before us that is at the age of 37.2 years. At that time, of the 100,000 people who are supposed to start out together, 50,000 are dead. A new-born male child has thus an even chance of living until, or dying before the expiration of 37.2 years. We can calculate this probable after-life for any age. Of the 59,123 persons who enter the age of twenty, one-half will be dead at the age of sixty or a little over, so that the probable after-life is 40.5 years. The last column shows the Average or Mean After-Life of the survivors in any period. It is simply the sum of years the persons live through, divided by the number of persons. It is not always the same as the probable after-life, because the death rate differs at different ages. At first it is much less, because the mortality is greater in the early years than in the later. Further on it is greater, for the reason that the mortality is greater in the later years than in the earlier.¹

The above table is for men only. The table for women shows a probable after-life at birth of 41.7 years, and a mean after life of 37.9 years. The women have at all ages a greater probable after-life than the men, and at almost all periods a greater mean after-life. There are only three periods of a woman's life when she has a greater death-rate than the man. These are during the age of puberty (14 to

¹The column "Probable After-Life" is not commonly found in English life tables. On the other hand, the "Mean After-Life" is often called "Expectation of Life" in England. The continental usage is better. See Farr, *Vital Statistics*, p. 478.

16), of child-bearing (31 to 35), and during the period of advanced widowhood (77 to 93) when the woman is unable to support herself and is often destitute.

In practical use such a life table as the one here given for a whole country must be very much modified. It includes the whole population, men, women and children; the vagabonds, tramps, criminals, and the lowest classes in the community. When we come to use it for insurance we must bear in mind that the insured are a select class, and that the expectation of life among them will be greater than in the population at large. It is therefore probable that the premiums will be paid oftener than is indicated in the general table, and an insurance company must modify its table by its own experience. At the age of ten, the probable after-life according to the Prussian table is 49.1 years; according to the Gotha Life Insurance company it is 52.9 years; according to the experience of twenty-two English life insurance companies it is 54.5 years. In the city of Berlin it is, for men, only 45.8 years. So also in all schemes for pensioning civil servants or soldiers, the table must be modified according to the character of the persons who are to enjoy the pension. In the case of civil servants it is probable that they will live longer than the population at large, and that the expense will be greater than if calculated on the ordinary tables. In the case of soldiers, the wounds and diseases they have contracted may make their life shorter.

The average length of life has a sociological interest. It is probable that it is becoming greater, owing to the better sanitary and medical care of the population. In some respects modern life brings increased

dangers and complications, but in general the ravages of starvation, violence and disease are less.

PART II.—ECONOMIC STATISTICS.

In studying the economic organization of society we find ample opportunity of applying the statistical method. Statistics first came into scientific use in the hands of political economists, and no one of the social sciences makes such constant use of them as political economy. In fact, we have here almost a super-abundance of statistical observations in the shape of statistics of imports and exports, of prices, of fluctuations in the rate of interest or discount, the amount of credit transactions, money in circulation, production of the necessities and luxuries of life, etc. The mind is embarrassed by this profusion of figures, and the ability to put them together so as to give a true picture of industrial society as it exists, is not often found. The first function of statistical science in dealing with economic phenomena is simply descriptive. It aims to give us the grand features of the economic world in which we live, and to depict the changes that are going on there. It exercises also its second function, which is to connect the different phenomena, or to put them into such shape that they can be connected with other phenomena of human society. The statistics of wages, for instance, are not merely of interest as a contribution to the theory of distribution in political economy, but are of wider interest as descriptive of the social condition of the community. Where the condition of the community is low, it is sometimes possible to connect it with other economic phenomena such as the tenure of land, the method

of payment of wages, the consumption of alcoholic liquors, or the competition of foreign countries.

It is not intended here to give even an outline of economic statistics. That would be a long and wearisome task. Economic statistics more than any other need to be used in connection with the question to be discussed. It is the intention merely to point out the important points for statistical investigation, and to treat of the method of statistical inquiry in economics. The most important question here is always one of method, for if the method be right the results may be as they please,—we can at least argue from them; while if the method be faulty the statistics are worse than useless. It is convenient to take up the different questions in order, and for this purpose to follow the usual divisions of political economy, *i. e.*, production, distribution and exchange.

*Production.*¹

The general statistics of production are comparatively easy to get, and to present. They are, as a rule, simply aggregates,—so many bushels of wheat, so many tons of coal, etc. In the case of agricultural products these statistics are necessarily estimates, for there is no means of subjecting the whole mass of products to uniform and official measurement. These estimates are made from year to year and commonly in advance of harvesting the crop, for the purpose of giving information to commercial men. It is very common to take the ordinary yield as 100, and to indicate the falling off or the in-

¹The following statistics are from Neumann-Spallart. *Uebersichten der Weltwirtschaft*, 1887.

crease of this year's yield by a number below or above that. When we compare different countries it is common to indicate the yield per acre or per capita of the population, as indicating the fruitfulness of the soil or the abundance of the produce.

Food.

Gathering together the statistics of all the countries in the world, we have a picture of the way the world supports its population. Products of the earth are divided into food, raw products and luxuries. Food material consists principally of live stock and the cereals. For live stock we have statistics of the number of cattle, swine and sheep. In Europe, the number has increased during the last century, but the number per capita of the population has decreased. It is impossible to insist upon comparisons between different periods or countries, because the quality of the stock varies. A general movement is going on by which the supply of live stock is decreasing in Europe, and increasing in countries outside of Europe, which supply the former with meat. In Great Britain and Ireland, for instance, the amount of meat imported is increasing, and the home product no longer begins to supply the need. The states on the continent are also obliged to supply their deficit with importations of live stock and meat from America; and with the improvements in the means of transportation this is coming more and more to be the case.

In bread, the same thing is becoming true. In former times each country grew its own cereals; now, the countries of Europe are dependent on America and Australia for their bread. In Great Britain and

Ireland, especially, the amount of land devoted to the cultivation of wheat and the other cereals is constantly decreasing owing to American competition. Two-thirds of the wheat consumed is imported. France also imports more than she exports, as do Germany and the smaller countries on the continent. Russia and Austria-Hungary are exporting nations, although American competition has of late years diminished the exports of the former. Recently, India has also come into the European market with wheat. The United States is at present the great wheat-producing country of the world. Her superiority is due to the virgin soil of the West, the use of machinery in agriculture, and the cheapness of transportation by which the wheat of the Western states can be sold in England and the other countries of Europe. During the thirty years from 1849 to 1880, the wheat cultivation of the United States underwent an entire change. In 1849 the center of cultivation was at longitude 81 degrees west; in 1880 it was at 89 degrees and 6 minutes west. In 1880 the ten prairie states produced 70 per cent of the total wheat. The changed relations may be seen in the following table of per capita production of the different sections:¹

	1849.	1880.
The New England States.....	.4 bushels.	.3 bushels.
The North Middle States.....	5.10 "	3.43 "
The South Middle States.....	7.72 "	6.36 "
The Ohio Valley States.....	7.53 "	} 18.00 "
The Trans-Mississippi States.....	5.12 "	
The Pacific States and Territories..	2.16 "	31.70 "

The yield is light compared with the countries of

¹Porter, *The West*.

Europe; in 1879 only 13.8 bushels per acre compared with 29.5 bushels in England.

Raw Materials.

The principal raw materials are coal, iron, wool and cotton. The combined statistics of the yearly production of these commodities make a grand picture of the resources of the world. The output of coal has increased enormously during the last twenty-five years,—from 136 million to 413 million metric tons. In 1885 Great Britain produced 161 million, the United States 103 million, and Germany 73 million metric tons. The fear lest the world's supply of the mineral may be exhausted seems to be groundless. It is estimated that there are in China 200,000 square miles of coal fields, in North America 193,870, in the East Indies 35,500, and in New South Wales 24,000 square miles, besides 9,000 square miles in Great Britain, 3,600 in Germany, 3,500 in Spain, 1,800 in France, and 900 in Belgium. The mines become harder to work as they are dug deeper, and it may be a question whether some day it will not be necessary to transport the labor and capital to the new countries; but even that day is far distant. In the use of coal per capita Great Britain leads the way, followed by Belgium, both countries having enormous demands for the use of coal in the iron industry. In Great Britain, during the years 1870-1885, 32.4 per cent of the coal was used in the iron industry, 21.8 per cent in the other great industries, 16.4 per cent in private houses for heating, 6.5 per cent in gas and water works, 6.4 per cent in mines, and the rest on steamships, locomotives, etc.

The annual production of iron increased from about 12 million metric tons in 1869 to nearly 20 million metric tons in 1884. Great Britain was at the head of all the nations with 7,534,000 tons ; then came the United States with 4,109,000 tons, Germany with 3,653,000 tons, and France with 1,629,000 tons. The per capita consumption is not easy to specify, because iron takes on such a variety of forms in manufacture, which cannot be reduced to a single denominator, and of which we have no statistics. The iron that goes into a cast-iron stove and that which goes into a steel knife blade do not represent the same sort of consumption. The rough figures are, per capita : Great Britain 121 kilograms, United States 88, Germany 70.4, Belgium 94, and France 58 kilograms.

Of textiles, the United States is the great producer of cotton and Great Britain the largest consumer, the United States next. Of wool, Europe is barely holding its own as a producer, the United States and Australia now producing immense quantities which are largely manufactured in Great Britain. Silk is produced mainly in China and Japan, and manufactured in France. Flax and hemp are extensively produced in Russia, and Bengal has a monopoly of the production of jute.

Luxuries.

Next to articles of food and the raw materials of manufactures come certain articles which are commonly called luxuries but the use of which is so wide spread and common that they may be termed comforts, if not necessities of life. These are sugar, coffee, tea, tobacco and alcoholic liquors. All of

them are very largely articles of importation and exportation, so that we are enabled to follow their consumption with some degree of certainty. In the growth of cane sugar, Cuba is easily at the head, the British West Indies and then the East Indies following. Germany and France have extensive production of beet-root sugar which, in some markets has driven the cane sugar out of use. The per capita consumption of sugar as an article of food would be an interesting indication of the prosperity of different peoples, for sugar is one of the comforts of life, the use of which increases with the economic well-being of the community. It is difficult to give exact figures of the consumption, because the home production is not always accurately returned, the imported sugar may be stored and not enter into consumption at the time, there are many different qualities, such as raw sugar, refined, molasses, etc., and sugar is used to some extent in manufacturing. Neumann-Spallart gives the following average per capita consumption in the principal countries: Great Britain and Ireland 30.46 kilos, the United States 18.69, Switzerland 10.54, France 10.12, Germany 6.80, Sweden 7.25, Norway 4.93, Belgium 3.52, and Italy 2.80 kilos.

Brazil is the great coffee-producing country of the world, supplying more than one-half of the total quantity consumed. Venezuela and Colombia also produce considerable quantities. In the East Indies, Java is the most important producer, followed by Sumatra, Ceylon and British India. The United States consumes the greatest absolute amount, and Germany next. The per capita consumption is reckoned by Neumann-Spallart for a series of years, 1875-

1881, to be, on the average, as follows :—Holland 7.20 kilos, Belgium 4.34, United States 3.66, Norway 3.53, Switzerland 3.01, Sweden 2.66, Germany 2.29, France 1.45, Italy 0.47, and Great Britain 0.44 kilos.

Until the beginning of the seventies, China had a virtual monopoly of the production of tea ; but since that time Japan and British India have entered the market with such considerable quantities that they have broken the Chinese monopoly. The great tea drinkers of the world, outside of Asia, are the Anglo Saxon races. The per capita consumption during the five years, 1881-1885, was as follows :—Australia 3.47 kilos, Great Britain and Ireland 2.165, Canada 1.674, United States 0.59, Holland 0.476, Russia 0.173, and Germany 0.034 kilos. It is curious to notice that the coffee consumers are small consumers of tea, and *vice versa*.

It is almost impossible to get complete statistics of the production of tobacco. In many countries it is produced at home as well as imported, so that the customs statistics are not sufficient. It is everywhere heavily taxed, so that there is great temptation to smuggle and to make false returns. The United States is the greatest producer, the cultivation of tobacco extending over twenty states, and the yield in 1884 being estimated at 541 million pounds, of the value of 44 million dollars. Cuba, of course, has an enormous export trade, and it is also produced in the other West India islands, in the East Indies, in China, Japan, and most of the countries of Europe. It is possible to make only a general estimate of the per capita consumption of tobacco. It is said to be :—in the United States 3.0 kilos, in Holland 2.8, in Belgium 2.5, Switzerland 2.3, Germany 1.9, France 0.85 and Great Britain 0.6 kilos.

Among the articles of luxury of the modern world, wine, beer and spirituous liquors occupy a prominent place. It is, unfortunately, impossible to give any exact statistics of their consumption. They are everywhere heavily taxed and are of such different qualities and values that international comparison is impossible. France is the greatest producer of wine, and also the greatest consumer. Block estimates the annual per capita consumption in France at 217 liters, in Italy at 120 liters, in Great Britain at only 2.3 liters. On the other hand, Great Britain consumes more beer than any other nation in the world in proportion to its population, its per capita consumption being estimated at 139 liters, that of Belgium at 138 liters, of Germany at 88.3 liters. The statistics of alcoholic liquors are still more untrustworthy.

*Statistics of Consumption.*¹

The above attempts to present the per capita consumption of various articles of food, raw materials, and the chief luxuries, suggest the notion of complete statistics of consumption, which continued from year to year would give us a picture of the economic prosperity of the community. They would serve also to compare the condition of different countries with each other, and to contrast different degrees of civilization. Besides, if complete and accurate, they might serve as a guide to commercial operations. The difficulties in the way of such

¹See three papers read before the Statistical Institute at Rome: Engel, "Sur la consommation comme mesure du bien-être des individus, des familles et des nations"; Keleti, "Sur l'alimentation en Hongrie"; Neumann-Spallart, "Sur la mesure des variations de l'état économique et social des peuples." *Bulletin de l'Institut*, 1887.

a complete statistical survey of consumption have been illustrated in the above cases. Where articles are produced at home, it is almost impossible to get the full statistics of their production. Even where they are imported, they pass into storage, are perhaps re-manufactured or re-exported, or used for a different purpose. Almost every article has different qualities or different forms which it is impossible to make comparable with each other. It is not probable that we shall ever get a complete picture of the consumption of a whole community. All we can do is to perfect the statistics of the aggregate consumption of certain important articles, and, thanks to the interest which commercial bodies and individuals are taking in this subject, these statistics are becoming more and more complete. In Germany, they have made an attempt to express the per capita consumption of principal commodities for a series of years, going back as far in some cases as 1863. But the statistics are of doubtful value, and international comparison difficult.

The Factors of Production: Land.

Such being the general features of the producing activity of the world, we turn now to the factors of production. It is easy to point out exactly what statistics can do here for political economy. It is not very much,—principally descriptive again. The first factor of production is land, and its productiveness depends upon the use to which it is put, and upon the inducement to careful cultivation which the distribution of it affords the actual cultivators. We can give the statistics of the distribution of land into arable, pasture and meadow, forest, and waste

land. The great features of agricultural life in different countries will appear in this distribution. For instance, more than one-half of the surface of Belgium is ploughed land, while in Ireland one-half is pasture land, and in Sweden sixty per cent is forest. None of these statistics are very trustworthy, because they do not rest on exact surveys, but on general estimates, and land is constantly being changed from arable to pasture and back again. We can also give the average size of the farms, which indicates whether the large or the small culture prevails. It is difficult to compare different countries, for the classification varies. The statistics are misleading in one respect also, viz,—that the size of the farm is determined by the fertility of the soil and by the kind of cultivation required. The cultivation of wheat in the United States, with scarcity of labor and the use of machinery, requires much greater acreage than the *petit* cultivation of the vine or the olive by hand labor in France. Any conclusions from the relative size of farms in the United States and France would be utterly worthless. In France 56 per cent of the farms are less than twelve and one-half acres in extent, while in the United States 45 per cent are over one hundred acres; this, however, is a difference which lies in the nature of things, and not in any social custom or system of land tenure. The tenure of land has always been a subject of interest in political economy, and the science has not hesitated to point out the advantages of a tenure which will give the actual cultivator some interest in the permanent yield of the farm and in its improvement. Peasant proprietorship is illustrated by France with its 5,500,000 land owners, four-fifths of them actual

farmers; the system of large estates, by Great Britain with its land in the hands of 321,386 persons holding above one acre each.

The Factors of Production: Labor.

The second factor of production is labor. The work of producing demands a certain number of laborers, which is a matter first of all of population. Then the population is divided into the productive and the unproductive, and this we have already treated of. It is important to know the occupations in which the people of any country are engaged. These statistics are as yet in a very unsatisfactory condition. The divisions and sub-divisions are so numerous (in Massachusetts they reckon 22,000), and they run into each other in so many instances, that it is impossible to reach any scientific classification. Since the introduction of machinery, the nomenclature has been so changed that it is impossible to compare the occupations of the present day with those of fifty years ago. For the same reason, it is impossible to compare a country advanced in the use of machinery with one less advanced. In the rural districts, again, the same man often pursues two or more occupations at the same time, as he may be both farmer and store-keeper, etc. For these reasons, the general statistics of occupations are not of very great value. They serve only to give a grand outline of the way the people of a country carry on the work of production. Agriculture demands the labor of the greater part of the human race, so that it may still be denominated the foundation occupation of man. In the United States 44.1 per cent, in France 48.8 per cent, in Germany 42.5 per cent, in England

only 13.2 per cent of the population are engaged in agriculture.

The Productiveness of Labor.

This depends largely on the number of hours the laborer works during the day. It would be an interesting statistical inquiry to determine exactly how much the laborer produces in days of varying length. The Massachusetts bureau of labor statistics investigated the question for the textile industries of that state, and came to the conclusion that "Massachusetts with her ten hours produces as much per man or per loom or per spindle equal grades being considered, as other states with eleven or more hours; and also wages rule as high if not higher." It is obvious that there must be a limit to the reduction of hours, and it is an interesting and difficult problem to say just when that point has been reached. In Germany, it is claimed that eleven hours is the most productive labor day. This brings us to another statistical problem, that is,—to determine the efficiency of the laborer. This can be gauged only by the quantity and quality of the product he can turn out in a given time. In textile factories this is often measured by the number of spindles or looms he can tend, and the rapidity of their motion.

The productiveness of labor depends, again, on the way in which it is applied. The most important element here, in modern times, is the introduction of steam as a substitute for human muscle. Engel estimates, that, in less than forty years, Prussia has added to the power of the nation a force equal to 9,000,000 horses, or nearly 64,000,000 men. It would

be utterly impossible for Prussia to support the men necessary to do the work of these steam engines.

The Division of Labor.

This is almost as important in the modern industrial process as the employment of machinery. It is not possible to follow it out statistically except in the bare enumeration of the different occupations, as in the Massachusetts census of 1885, or in the distinction between the large and small industry. It is, of course, difficult to draw the line exactly between the large industry and the small, or between factories and workshops. In Prussia, in 1875, industries were classified according to the number of men they employed. Out of 1,667,104 factories and workshops, 1,623,591 employed 5 or less men, 17,685 from 6 to 10 men, 20,474 from 11 to 50 men, 4,362 from 51 to 200 men, 905 from 201 to 1,000 men, and 87 over 1000 men. Of the employees 2,246,959 were employed in the small workshops, *i. e.*, those with five or less workmen, 1,378,959 in the large factories. The small industry may be said to have a firm hold still in Prussia. The chief importance in this classification is the social position accompanying the occupation. In the large industry the mass of the men are in the position of wage-receivers, with no immediate interest in the business, and without any chance of advancement. In Prussia, of all the persons in the small industry, 72.56 per cent were proprietors or managers, and 27.44 per cent assistants, laborers, and apprentices; in the large industry, 3.65 per cent were proprietors and managers, 4.98 per cent were salesmen, superintendents, etc., and 91.37 per cent were laborers and apprentices.

*Emigration and Immigration.*¹

The supply of labor and competition among the laboring class are affected in the modern community by emigration and immigration. These are comparatively modern phenomena. In former ages men sometimes changed their domicile from religious or political motives. But the effort was so great, the dangers so numerous and unknowable, that emigration was always small and only under the most powerful feelings. During the last forty years all this has changed. The knowledge of foreign countries has spread; the means of transportation have improved and are cheaper; and now thousands of human beings expatriate themselves every year from no other motive than to better their economic condition. For the United States particularly, (for by far the greater part of the emigration is from Europe to this country), immigration is a very powerful factor in its political and economic development. Since the year 1820 more than fourteen million persons have come to this country.

Our statistics of this movement are pretty complete, or may be made complete by the combination of the statistics of emigration with those of immigration. In some countries of Europe they require a permit to leave the country, and thus pretend to keep an accurate record of all emigrants.

¹Complete statistics of emigration are to be found in the Italian publication, *Statistica della Emigrazione Italiana*, 1886. See also, *Emigration and Immigration: Reports of Consular Officers of the United States*. Washington, 1887. I have attempted to analyze the effect of immigration on the United States in three articles in the *Political Science Quarterly*, for March, June, and September, 1888; and in the *Bulletin de l'Institut international de statistique*, 1888.

With the modern means of transportation these records are always deficient, for many leave without getting a permit. More accurate are the statistics of those sailing from the principal seaports. In addition, we have the record of those landing at the seaports of the United States. These three figures never correspond. In 1880 for instance, the number of Germans with permits to leave and settle in the United States was 21,251; the number of Germans leaving the ports of Bremen, Hamburg, Stettin, and Antwerp was 103,115; the number of Germans arriving in the United States was 134,040.

The fluctuations in the number of emigrants from year to year seem to be determined principally by economic causes. Bad times in Europe, such as the Irish famine of 1846 and the German scarcity of 1853, result in an enormous flood of emigrants; bad times in the United States, such as the civil war of 1862-3 or the crisis of 1873, result in a decrease of immigration. There are always more men than women among the immigrants. Of those that come to the United States about 60 per cent are males. The immigrants are in the most productive period of manhood and womanhood; 80 per cent are fifteen years of age and over. Three-fourths of them are unskilled laborers.

Emigration does not seem to have any great influence on population, because the places of the immigrants are immediately filled up by births. Thus in Germany from 1875 to 1880, the excess of births over deaths was 2,887,882; the actual increase of the population by the census was 2,506,689, showing a loss by emigration of 381,193. Only in Ireland is there an actual decrease caused by emigration. The

effect on population is best measured by comparing the number of emigrants per 1000 of the population with the excess of births over deaths per 1000 of the population. In 1885 the emigration was: from England and Wales 4.59, from Scotland 5.47, from Ireland 12.20 per 1000 of the population; the excess of births over deaths was 13.50, 13.18 and 5.11 per 1000.

Immigration, naturally, causes an increase of population. There is, first, the actual addition of the immigrants to the population, and secondly the excess of their births over their deaths. It is impossible to follow this out accurately, because the immigrants and their descendants are not distinguished from the natives, after the first generation of children. Thus, while in 1880 the number of foreign-born persons in the United States was 6,679,943, the number of persons having one or both parents foreign-born (including the above) was 14,922,744. But many of the immigrants had been here long enough to be represented by grandchildren or great-grandchildren, and, guessing at the number of these, it seems probable that at least twenty millions of the inhabitants of the United States in 1880 were immigrants or the descendants of the immigrants since 1790. A second method of estimating this number is by taking the rate of increase of population as indicated by the censuses of the United States, deducting the increase due to immigration and the natural increase of immigrants during the decade, and then allowing to the native and the immigrant population the same rate of increase during the decade. This gives about the same result as above.¹

¹See above, p. 24.

The economic effects of emigration and immigration must be very important. By emigration there is a constant abstraction of persons who are in the most valuable period of human life. The native country of the emigrant has had all the expense and trouble of rearing him, and then loses him just as he is beginning to repay this expense. The country that receives the immigrant has that number of able-bodied persons added gratis to its laboring or productive population. The measurement of this economic gain is not easy. One common method is to calculate the cost of bringing up a child to the age when it is able to support itself, and to count every adult immigrant as worth that sum. Thus Engel estimated that it cost 754 thalers to rear a German child to the age of fifteen, when it was presumably able to support itself. Every immigrant we get above the age of fifteen is worth that sum to us, for that is what we have been saved. This estimate is a fallacious one. The value of the immigrant laborer is not what he cost the old country, but the amount of wealth he will produce in the new. From this we will have to deduct, naturally, the cost of maintaining him during the remainder of his life. This is the economic value of the man. In order to ascertain, therefore, the economic gain by immigration we must know the rate of wages, the cost of living, and the ages of the immigrants. Capitalizing the difference between the rate of wages and the cost of maintenance according to the expectation of life, we shall have the present value of the man. By this method Dr. William Farr estimated that the value of the emigrants leaving England in 1876 was £175 per capita, and that the money value of

the 8,000,000 people that left England during the years 1837-1876 was 1400 million pounds sterling, or on an average about £35,000,000 a year.

The Factors of Production: Capital.¹

The third factor of production is capital, and it is equally important with land and labor. It is of interest to investigate, in each country, the total amount of capital and its relation to the total national wealth, its distribution over different parts of the country and in different industries, whether it is circulating or fixed capital, its increase or decrease, etc. International statistics on these points would be extremely valuable. It is, however, a difficult and arduous task to collect such statistics, and the statements of individuals are not always to be relied upon. Even where the persons making returns are entirely honest, the returns themselves are not always homogeneous. All business is conducted on credit, and this credit acts as capital, even where it consists only in extension of time in which to pay for goods. One firm of manufacturers may own their building and return it as part of their capital as it really is, while another firm engaged in the same business may rent their building and not put it in as capital. The capital stock or the bonded indebtedness of stock companies and corporations may or may not represent the full amount of the capital on which they are doing business. In many cases, the stock has been watered; in others profits have been put back into the business without increasing the nominal amount of capital.

¹Giffen, *Essays in Finance*. C. D. Wright, *Problems of the Census*. C. F. Pidgin, *Practical Statistics*.

Statisticians have confined their efforts for the most part to estimating the national capital; and this is often taken to be identical with the national wealth, a distinction being drawn between that part which bears an income and that which does not. Thus Giffen, on the basis of the income tax, calculates the income-bearing wealth of Great Britain as £8,548,120,000. This was in 1875. In 1865 the amount was £6,113,000,000, an increase of nearly 40 per cent in ten years. While population was increasing at the rate of about one per cent per annum, wealth increased at the rate of four per cent per annum. The increase during the decade was three times sufficient to pay the national debt, and the nation could have afforded to lose one-fourth of all its property and would still have been as rich per capita as in 1865, notwithstanding the increase in population. For the United States, all we have is the estimate of the census of 1880, which made the total wealth of the United States equal to 43,000 million dollars.

Distribution.

By distribution is meant, technically in political economy, the division of the product among the persons who have contributed to produce it; and economists distinguish rent, interest, profits, and wages. The recipients of these four portions are not always distinct persons. The capitalist may at the same time be land-owner and employer, and the interest on his capital be inextricably intermingled with his rent and profits. There is scarcely any pure rent, for almost all land has been improved and the nominal rent includes some interest on capital invested. There is also scarcely any pure profit, for almost

every employer is at the same time capitalist to a greater or less extent, and his nominal profits cover interest on capital and compensation for risk which it is impossible to insure against. We cannot distinguish rent and profits accurately enough to have any statistics of them, even if the technical difficulty of inducing men to reveal their real rent or real profits were not insuperable. All attempts to get at profits by estimating the total value of the output and comparing it with the sum spent on raw materials and on wages are fallacious, because they do not take into account the risk, the other items of expense, the amount of capital actually in use, etc. So also, to average the dividends of railroad companies and compare them with the amount of capital stock is of no value, because it takes no account of watered stock, etc. Even statistics of the rate of interest and discount take on the form of a mere record of the fluctuations from time to time, because interest varies according to security, and we must proceed on the basis of perfectly good security. There is no such thing as an average rate of interest, at the same time, on the same security. The only share of the product that we can follow out statistically is wages, and we can follow them out solely because there are a number of men who stand together as a class, namely, the wage-receivers. Even here we can study wages statistically, not as a share of the product and in its relation to other shares, but only as a question of income,—the income of a large number of persons. The statistics of wages have interest, therefore, not as a solution of the law of distribution, but as an answer to the social question of the well-being of a number of persons in the community.

*Wage-Statistics.*¹

It is well recognized, now, that there are three parts to statistics of wages: the money wages reduced to such a form that we can tell about what the command of laborers over money is; the cost of living, that is, the prices of the articles which the laborer consumes; and the relative share of the laborer's income absorbed by these different articles.

It seems probable that the best way to get the money wages is from the large employers,—the working men themselves being too ignorant or too interested to give correct and unbiased returns. It is best to get *actual* wages, and the number of men employed at each actual wage; estimates are apt to err on one side or the other. In averaging wages, care must be used to take persons of a homogeneous class. For instance, there is no sense in averaging the wages of men, women and children in an employment; the average is too strongly affected by the relative number of each to be indicative of anything in the social condition of the class. So also, it is useless to average the wages of skilled and unskilled workmen,—the average is neither the one thing nor the other. It is better for these reasons to arrange the wages by classes:—so and so many labo-

¹Victor Böhmert, *Die Methoden der Lohnstatistik in Zeitschrift des Sächsischen statistischen Bureaus*, 1885, Heft III und IV; Reports of Massachusetts Bureau of Labor Statistics, 1884, 1885 and 1886; Edward Atkinson, *The Distribution of Products*; Leone Levi, *Wages and Earnings of the Working Classes*. I have criticised the attempts to get wage statistics in the United States in an article on American Labor Statistics, *Political Science Quarterly*, March, 1886; and in *Wage Statistics and the Next Census*, *Quarterly Journal of Economics*, July, 1888.

ers receive from one to two dollars per day, so and so many from two to three dollars per day, and so on. This enables us to decide upon the actual income of a large number of persons in the community, without committing ourselves to any fixed average which may have been affected by accidental circumstances.

The cost of living for workingmen has been analyzed most successfully in the investigations of Mr. Edward Atkinson and the Massachusetts bureau of statistics of labor, by collecting from boarding houses and workmen's families the exact items of expenditure. From these returns it would appear that food can be furnished in this country for from twenty to twenty-five cents per day for each adult person. To this must be added the other items, rent, fuel, medical attendance, etc.

The relative importance of these items is ascertained from workmen's budgets; and it appears that a Massachusetts workingman with an income of \$754 per annum spends 49.3 per cent of it for food, 18 per cent for clothing, 12 per cent for lodging, 5 per cent for fuel, 5.5 per cent for education, etc., 3 per cent for medical attendance, 3.5 per cent for recreation. It appears from this and other investigations that the lower the income the greater the proportionate amount spent for bare subsistence.

With these three facts, amount of wages, cost of living, and items of expenditure, it is possible to determine how many of the working men in the community are able to earn enough to afford them a comfortable subsistence. There are, of course, a number of minor difficulties besetting statistics of wages, such as the number of idle days, the opportunity for extra work, the interval of payments, pay-

ment in truck, etc., which it is necessary to pass over here, although they often affect the prosperity of the laborer.

One of the desirable things in statistics of wages is to institute a comparison between different countries, or at successive periods of time, in order to determine the relative prosperity of the laboring class in various places, and past and present. Either comparison is difficult. When we compare the laborers of one country with those of another, it is found impossible to co-ordinate industry with industry, because, owing to variations in technique, the labor may not be of the same class. In one country, machinery may be extensively used and the number of women and children employed in that particular industry be larger than in a second. Any average wage in the two countries would be misleading from the simple fact of its representing, in the one case, the wage of adult skilled labor, and, in the other, that of unskilled, or female and half-grown labor. Possibly a classification of wages would give us the comparative incomes of the working classes in the two countries. The comparison between past and present wages shatters on the same difficulty of unlike employments,—a cotton spinner now not being the same thing as a cotton spinner of fifty years ago,—and on the further difficulty that we lack the data for former years. Mr. Robert Giffen's essay on the "Progress of the Working Classes" is a notable attempt to prove that the laborers are better off now than they were fifty years ago, but an examination of the data given in that essay and in a subsequent one devoted to the same subject shows that they are historical rather than statistical in their character. Statistics have not yet

successfully solved this problem, but there is evidence that, with improved methods, the science will make some important contributions to this interesting question.

Relative Incomes.

Wage-statistics lead naturally to the question of the general distribution of wealth among the different members of the community, and especially to the vexed question of the relative growth of small and of large incomes. It is often said that the rich are growing richer, and the poor, poorer. It is already plain that statistics cannot answer this question directly. We can have no general census of incomes, for many men can not give their true income, and many will not. We can only get at it indirectly, from an analysis of income tax returns, of wages, of inheritance and probate duties, etc., which taken together will give us a picture of the condition of the various classes in the community. Giffen has made a contribution to this subject in the well-known essays mentioned above. The general result of the English investigations is to show that the middle incomes are increasing at the greatest rate, while the growth of wealth in modern countries is coming to the good of all classes in a general improvement of the standard of comfort and well-being. Some Prussian returns, given in the table below, do not appear to point in exactly the same direction. None of these returns satisfactorily answer the question of well-being, because there is much in legislation, governmental action, public opinion and education, that comes to the good of the working classes, but which cannot be measured statistically. Finally, there are many other statistics, such as those of pau-

perism, of savings-banks, of education, of temperance, of vice and crime, of mortality, etc., which disclose facts having an important but indirect bearing on the well-being of the community.

Increase in Incomes—Prussia, 1852-1873.

INCOMES.	Number of Contributors increased from 100 in 1852 to				
	In 1855.	In 1860.	In 1865.	In 1870.	In 1873.
A. Class-Tax.					
Under 300 dols....	104.0	109.8	116.9	122.4	122.8
300-750 "	120.6	149.4	158.2	167.3	175.5
Up to 750 "	104.4	110.7	117.9	123.4	124.0
B. Income-tax.					
750- 1,200 dols	114.0	134.7	154.7	187.0	210.2
1,200- 2,400 "	114.8	141.0	168.0	193.0	232.3
2,400- 4,500 "	119.6	142.3	174.7	207.1	255.9
4,500- 9,000 "	117.4	158.3	195.7	238.4	324.8
9,000- 18,000 "	132.3	166.7	233.0	314.5	470.6
18,000- 39,000 "	133.8	175.0	206.3	295.0	576.3
39,000- 75,000 "	105.3	157.7	168.4	242.1	568.4
75,000-150,000 "	83.4	150.0	150.0	300.0	533.3
Over 150,000 "	400.0	300.0	400.0	700.0	2200.0
Over 750 "	115.0	137.7	160.0	192.8	225.7

*Exchange.*¹

The value of statistics in the department of exchange is principally descriptive. We have first of all the means of transportation,—railroads and shipping. Statistics give us a picture of the growth of railroads, the annual increase in mileage, the amount of rolling stock, the tonnage per mile, the number of passengers, the number of accidents, the cost of the road, the gross earnings and expenses,

¹Neumann-Spallart, Uebersichten der Weltwirtschaft; Robert Giffen, Essays in Finance, Second Series; Institut international de statistique, Comité de la statistique commerciale, *Bulletin*, 1887.

etc. The railroad facilities of a country may be measured either by the number of miles of road per capita of the population, or the number of miles of road per square mile of territory, or the train service per inhabitant, that is, the total number of miles run by passenger trains during the year divided by the number of inhabitants of the country. None of these methods is very satisfactory. In shipping, we can note the number and tonnage of vessels, the distribution of tonnage among the different nations of the world, or in different bodies of water. For instance, in former times the center of commerce was in the Mediterranean; now it is on the North-Atlantic coast and in the German ocean. Steam vessels are rapidly superseding sailing vessels, so that more than one-half of the ocean freight is now carried by steam.

Imports and Exports.

The great international movements of commodities are shown by the statistics of imports and exports. These statistics are of increasing interest and importance as portraying for us the commercial intercourse of the world. It is impossible but that, as they are perfected and made accurate, they will give us the solution of some of the problems of international exchange. The administrative difficulties in the way of making them complete and accurate prevent their being of as much value as they might be. Statistics of imports and exports should give both the quantity and the value of the articles. The former is given in the bill of lading. The latter is dependent on the declaration of the merchant or the appraisal of the custom house officer.

If the article pays a duty, the valuation is often too low; if it enters free, the valuation is often carelessly made. There is no uniform system of classification for all countries, so that a comparison of the imports of one country with the corresponding exports from another is difficult. So too, the destination of the goods is often recorded carelessly, or the final destination may not be known to the shipper himself. Such are some of the difficulties in the way of our statistics being what they ought to be, namely,—a complete picture of the commercial intercourse among the nations of the world.

The statistics of imports and exports are often used as indicating, by their increase or decrease, the prosperity of a country. It is common to take, for this purpose, simply the money value from year to year. This money value is affected, however, by the price as well as by the quantity. The money value of the imports may have decreased simply because prices have gone down. The ability of the country to consume is the same as before, only it has to pay less for what it consumes. The only way to avoid such fallacies is by combining the price with the quantity. One way to do this is to estimate what the commodities would have cost at the prices prevailing the year before. It is, however, extremely difficult to carry on this comparison so as to cover a series of years.

Prices.

The statistics of prices are very important and at the same time extremely difficult to handle. There is an abundance of material, for the commercial organizations, such as boards of trade, chambers of commerce, etc., are registering daily the prices in

the transactions carried on among them. The difficulty is to get some sort of average which shall express the fluctuations from day to day and from year to year. The common expedient is to take the highest and the lowest prices of the day or the year, or the average between the two. This average is a mere numerical one and amounts to nothing, for one extreme may have been due to entirely exceptional causes. For instance, if during a day 100,000 bushels of wheat are sold at \$1.00 and 1000 bushels at \$1.02, the average price of wheat to the purchasers of wheat that day is not \$1.01, but is much nearer \$1.00. The only correct average is attained by taking into account the quantity as well as the price; but with the thousands of transactions taking place every day, that would be an enormous task.

The difficulty only increases when we try to combine the average prices of many different commodities, in order to tell whether prices in general have risen or fallen. This is commonly done by a so-called "index number."¹ A list of the more important articles is made, and the prices of these articles are taken for a year or for a series of years. The combination of these prices is used as a base number, and is represented by, (say), 100. If the combination of the prices of these same articles for any subsequent year is greater than the base number, then prices have risen, and they have risen in proportion as the number is greater, on the basis of 100. There are numerous difficulties with an index number, although the idea in itself is a correct one. One

¹Papers by M. Beaujon and Robert Giffen on "Index Numbers" in *Bulletin de l'Institut international de Statistique*, 1887.

is in choosing the articles which shall be included in the number. One article may be important because of the quantity consumed, another on account of the quantity exported, a third because it is a necessary of life. When a list is made out it must be used for all future time, but in the course of time some articles may have sunk into insignificance, and others which had not been included may have acquired prominence. Then again, shall all the articles have an equal weight in making out the index number? In England, shall copper have the same weight as iron, silk as cotton? If we try to assign different weights, then new and subjective judgments must be made which will influence the number but may not command general assent. Finally, the price of labor, the most important commodity of all, is not commonly included in an index number, although a rise or fall in it is of the utmost importance both to the laborer and to the manufacturer or employer. It is safe to say that we have not yet reached the perfect index number.

The counterpart of these statistics of prices is the statistics of money and the means of credit, for prices are affected by the quantity of money in circulation.¹ The actual amount of specie money in circulation can be arrived at only indirectly. The mint records are not final, because the coins may have been melted down or exported. They serve as a basis for an estimate and may be combined with the statistics of imports and exports, the quantity lying in bank-

¹See particularly Soetbeer, *Production of the Precious Metals*, translated by Professor Taussig and published by the Department of State in Consular Reports, December, 1887.

vaults, etc., to estimate the quantity in the country. The amount of mercantile credit can be estimated from the transactions of banks and clearing houses. The effect of all this on prices, however, is for the most part conjecture.

PART III.—STATISTICS OF VICE AND CRIME.¹

We include under "Moral Statistics," according to Mayr, the statistics of all those actions of men which may be traced to ethical motives or to the influence of moral or immoral circumstances. In many respects it is the most interesting field of statistical inquiry. The actions themselves are of deep concern to the community and to the individual, and any theory in regard to them is sure to awaken considerable interest. Above all, it is these actions for which we hold men responsible and for which we punish them if they transgress, and any investigation which seems to show influences affecting the freedom of the individual to do or not to do as he pleases, has an important influence in determining our position towards the guilty person, and our theory of social action. These statistics have but an indirect bearing on economics and hence will be treated here very briefly, only a few examples being given in order to furnish illustrations of the effect of statistical inquiry upon the doctrine of the freedom of the will.

¹Von Oettingen, *Moral statistik*; Morselli, *Suicide*; Mayr, *Die Gesetzmässigkeit*, etc.; *Movimento della Delinquenza 1873-1883*, (besides Italian statistics contains international comparison of frequency of principal crimes); *Starke, Verbrechen und Verbrecher in Preussen*.

Passing over the statistics of suicide and of vice, the former of which furnish interesting data for the determination of the influence of race, of climate, and of external circumstances over the so-called free actions of men, but which are of less importance than the statistics of crime in general, we proceed directly to the latter. It is well to point out here that the value of the results of criminal statistics has been greatly exaggerated. They are not complete enough to admit of international comparison, or to bring into intimate connection with national characteristics and customs, as has often been done. The classification of crimes is so different in different countries,—there being often included under one general name, a variety of acts which would not be included under that name in another country; the administration of justice is so different, in some countries with trial by jury, in others by judges with summary jurisdiction; the efficiency of the police force in the detection and arrest of the criminal is so various:—that any international comparison of criminality is apt to be misleading.

Even in any one country, it is difficult to measure the extent of the criminality. A large amount escapes detection or conviction. Shall we pay any attention to those who are arrested, or accused of crime, but who are acquitted from insufficient evidence? Again, how shall we value the different kinds of crime? Murder and arson show an entirely different disposition, and are of different import to the community, from petty larceny and drunkenness. It is necessary to divide the crimes into the more and the less serious, and to trace the history of each. Further, the most important question of all is the cause of crime.

Here we have the evidence of the prosecution, which is not altogether reliable because its object is to convict the man. We have also the history of the criminal himself, his parentage, his occupation, his age, etc.; but these things are not always given in as complete a form as is desirable. With all these difficulties, there are still certain general features of the world of crime which statistics bring out.

Kinds and Causes of Crime.

Statistics show a great regularity in the amount of crime from year to year. In England, for instance, the number of crimes is shown in the following table :

	INDICTABLE OFFENCES. Annual.	PER 1000 OF POP.	NO. PERSONS CONDEMNED TO IMPRISONMENT. Annual.	PER 1000 OF POP
1857-61	53.674	2.72	128.767	6.54
1862-66	51.658	2.47	139.941	6.72
1867-71	54.036	2.43	161.369	7.27
1872-76	46.718	1.97	167.354	7.07
1877	50.843	2.07	187.412	7.63
1878	54.065	2.14	188.060	7.47
1879	52.447	2.08		
1879-80	52.427	2.06		

Considering the enormous economic and social changes that have taken place during the period, the regularity is astonishing. Of the indictable offences in 1879-80, 75 per cent were crimes against property without violence, 13 per cent were against property with violence, and 5.4 per cent were against the person. This proportion of crimes against the person compared with those against property varies greatly in different countries, and is apparently influenced by a great many things such as climate, the season of the year, economic condition, race, sex, etc.

Crime is more frequent in the city than in the country, a fact that is easily accounted for by the age of the city population and by the attractiveness of city life to those with vicious tastes. There are generally four men to one woman among the criminals; and the criminal age is that between 30 and 40. There is less crime among the married than among the unmarried, although there are some exceptional returns. The criminal class are for the most part illiterate; and there is a close connection between the criminal and the vicious classes. In regard to occupations, the great mass of criminals come from the lower classes, the laborers, charwomen, etc. The influence of scarcity of food is plainly discernible in the increase of crimes, especially those against property. The individual psychological motive is difficult to ascertain, because it is usually concealed by the defence. In the crimes against the person, the passions play an important part; and even in crimes against property such as arson,—revenge, envy and covetousness have great influence.

Effect of Penalties.

The penalties seem to have little deterring effect. The number of habitual criminals is always very great. In England the number of habitual offenders, that is criminals who had been punished before, was 40 per cent of the whole. Of these 35.5 per cent had been punished once before, 16.1 per cent twice, 9.8 per cent three times, 7 per cent four times, 5 per cent five times, 6.8 per cent 6 to 7 times, 6.3 per cent 8 to 10 times, and 13.5 per cent over 10 times before. It is these figures showing the connection of crime with ignorance, vice, poverty, bad social surroundings, in-

temperance, etc., and the persistence of the criminal in a course of conduct the bitter fruits of which he has already tasted, that make us more disposed to treat crime as a disease of the social body than as a sin of the individual and a product of the free-will of the sinner. It is safe to say, that in the refinement of criminal statistics we have the hope of reaching some definite comprehension of those actions of the individual which seem so destructive to his own happiness and to the welfare of the community. Into the refinements of this study we are not able to enter in this brief monograph.

III.

STATISTICAL METHOD OR STATISTICAL SCIENCE?

It will have become plain by the above outline of statistics, that, as was mentioned in the introduction, they are useful to us in three ways, viz: (1) merely descriptive,—for instance, the amount of coal produced in different countries; (2) as revealing by the observation of a large number of cases certain facts which are not otherwise revealed,—for instance, the average duration of human life or the death-rate at different ages; and (3) finally, as bringing phenomena into juxtaposition so that one is the explanation of another,—the number of marriages and the price of wheat. It is a mooted question whether the body of knowledge thus brought together deserves the name of a *science*, or whether it is simply a *method* of getting material for other sciences. The question is not a merely formal one, for upon its answer depends

the position of the statistician and the authority with which he speaks. There are two divergent views which we may briefly characterize as the English and the Continental.

The English View.

This has been best set forth by Mr. Wynnard Hooper in a paper read before the London Statistical Society, and which met the assent of most of the members present.¹ The author agrees with the assertion made by Professor Ingram at the meeting of the Social Science Association at Dublin in 1878:

"It is plain that though Statistics may be combined with Sociology in the title of Section F., the two cannot occupy a co-ordinate position. For it is impossible to vindicate for statistics the character of a science; they constitute only one of the aids or adminicula of science."

Mr. Hooper sustains this position by the following arguments:—If we examine the phenomena revealed to us by statistics, they will be found to be simply phenomena of human life such as are already dealt with in sociology. To use the term statistical science would be to supersede the term sociology. At the present time the latter science is already divided into well recognized sub-sciences, political economy for instance, each dealing with phenomena of a certain kind. To make statistics a science would be to introduce a cross division that would be extremely puzzling. Then again, although statistics already furnish valuable material for other sciences such as political economy, political science, etc., they are not at all complete enough to form a science by themselves.

Rejecting therefore the term statistical science, Mr.

¹Journal of the London Statistical Society, March, 1881.

Hooper gives the following definitions: By the term statistics we always mean statistics of something, as the number of bags of coffee in the London warehouses at a certain time, or the receipts of the London and Northwestern railroad during a week. The statistical method is a scientific procedure involving the use of statistics. It includes not only the processes by which the statistical quantities are dealt with, *e. g.* noting the difference between the statistics of the coffee of one week and those of the corresponding week of the preceding year, but also the superintendence of the processes by which the primary statistical quantities are obtained. "I regard statistics, which I shall in future call statistical analysis, as a method of scientific inquiry, a certain Instrument of scientific investigation whether it is applied to sociology, to meteorology or to any other science. In saying that it is an instrument I mean that its purpose is to enable us to perceive and measure with more or less accuracy phenomena which we could neither perceive nor measure otherwise. In the service it renders to man it is therefore analogous to the microscope which enables us to perceive magnitudes, and to the polariscope which enables us to perceive tints that are not otherwise perceptible to us."

It must be confessed that the views expressed above correspond to the general notion of statistics prevailing in England and the United States. By statistics we commonly mean the figures expressing certain numerical facts, and our only books on statistics are the almanacs and handbooks containing these long and elaborate tables of figures. We have in the English language no word corresponding to the

German "*Statistik*," or to the French "*la statistique*," expressing the science as well as the material. The science of statistics is in a good deal the same position that political economy would have been in if we had continued to use the term "political arithmetic," instead of the modern "political economy." On the continent, however, the leading statisticians such as Mayr, Engel, Block, Bodio, Morpurgo, etc., are unanimous in desiring to use the term statistical science, and not to treat statistics merely as a method. When we consider that these men have done more than any others to develop statistical methods and knowledge, and also that they are not mere doctrinaires, but the heads of statistical bureaux and practical men, it will be worth our while to examine their reasons for desiring this. Their views are as well expressed by Mayr as by any one, and we will content ourselves by quoting him.

The Continental View.

Mayr desires to use both the terms statistical or numerical method, and statistical science. The method we can use in natural science, as well as in the social sciences. We can have statistical observations of the temperature or the annual rainfall, just as much as of births, deaths and marriages. For all these things Mayr desires to use the term statistical or numerical method. For the statistical method applied to the phenomena of human society, he desires to use the term statistical science. Statistical science is therefore a branch of social science distinguished by its method. His definition is: "The systematic knowledge of human society, (of the phenomena of the same and the laws derived

from these), gained by the quantitative observation of numerous instances." ("Die systematische Darlegung und Erörterung der thatsächlichen Vorgänge und der aus diesen sich ergebenden Gesetze des gesellschaftlichen menschlichen Lebens auf Grundlage quantitativer Massenbeobachtungen").

The question at once arises:—Why should we use the term science when the numerical method is applied to the social sciences, and only method, when applied to the phenomena of natural science? Mayr's answer to this is, that in the natural sciences the statistical method plays only a subordinate part. The favorite method there is the experimental, and when once a law has been established we need no further observations. When we have discovered that water freezes at a certain temperature, we are sure that water will always freeze at that temperature. In botany, the observer comes across a single perfect specimen of a plant. He analyzes it, the number and arrangement of petals, sepals, the form of the leaf, etc., and he is done. Every subsequent flower of that kind will show those characteristics. He does not need the statistical enumeration unless he is describing the flora of a country, in which case he notes every time he comes across that particular plant in a different locality. The statistical method in the natural sciences plays an altogether subordinate part. On the other hand, take a fact in social science,—the average duration of human life. The observation of a single instance gives us absolutely no information. We must observe the duration of life of thousands of individuals, and then get the average. For social science, the statistical method is so important that it deserves the rank of a science.

To this conclusion the statisticians of the continent have been driven by practical experience. Statistics were collected at first simply for administrative purposes. They were afterwards used by the professors for the purpose of illustrating their lectures on political economy. These professors soon found it necessary to give a few lectures on statistical method, for the facts were so important that the validity of the method became very important. It was inconvenient, however, to separate the different parts of statistical inquiry; for how could one understand economic statistics without knowing something of the population, or statistics of vice and crime without investigating the economic and social condition of the people? Thus in German universities we first began to have lectures on statistics, given generally by the professors of political economy, afterwards and at the present time by heads of statistical bureaux or by special professors of statistics.

It is not possible, within the limits of this brief monograph, to discuss the merit of these opposing views. Among the continentals there are all shades of opinion. Some call the statistical method simply an application of inductive logic; and the latest German writer on political economy (Gustav Cohn), has again denied to statistics the rank of a science. It is awkward to use the term statistics in the singular as denoting a science; but still we do use the terms mathematics, economics, and politics. To "statistical science" there seems to be no more objection than to "political science." Aside from this merely verbal difficulty there seems to me no real objection to calling statistics a science. The

advantage of doing so is that it rescues the study from the barrenness which results from viewing its object as simply the collection of masses of figures with which the statistician has nothing further to do. The habit, prevalent in England and America, of printing page after page of figures without note or comment, has resulted in a popular dislike, almost amounting to horror, of this most useful method of investigation in social science. We need to know for what purpose the observations were made and what they show. The continental view attains this end most successfully.

In view of this practical need it is, in my opinion, expedient to recognize statistics as a branch of social science employing a specific method, and devoting itself to those problems of life in society which can best be solved by that method. It is useless to try to separate the statistician and the sociologist, saying that the former shall supply the material and the latter work it up into a science. The separation may be made in formal thought, but it cannot be carried out in practice. The statistician must be enough of a sociologist to understand the nature of the problem his statistics are to solve, or he will misdirect his efforts. The sociologist must be enough of a statistician to understand the method and the value of the results, or he will misinterpret the material, and formulate laws which have no existence. It is impossible to sever the two without destroying the efficiency of both. The business of the statistician is not merely to furnish material, but also to draw from his observations what those observations really mean, and the social laws that are established by them. He also is best fitted to formulate the

problems which it is desirable to solve, and then to direct his energies to solving them. It is in this sense that it seems to me expedient to cultivate not only statistical method but also a statistical science.

IV.

THE FREEDOM OF THE WILL.¹

The tendency of every social science is to reduce the phenomena of human life to the position of actions controlled by law,—that is, to limit the province which in former times was allowed to the freedom of the human will. When statistics began to investigate such actions as marriage, vice, crime, etc., which up to that time had been supposed to be more or less capricious, it also invaded the domain of the freedom of the will. It happened too, that one of the most talented among the early investigators,—one indeed who has sometimes been called the father of modern statistics and whose personal influence, extending over nearly a century of human life, has been greater than that of any other single man in this study,—that Quetelet expressed the results of his investigations into crime in terms which seemed to imply that the criminal was the mere blind instrument of social forces over which he had no control. It is scarcely necessary to repeat those burning sentences in which he declared: “There was a budget which was paid with more regularity than that of

¹ Knapp. *Neuere Ansichten über Moralstatistik*. Quetelet, *Physique sociale*. Mayr. *Die Gsetzmässigkeit*, etc. Venn. *Theory of Probabilities applied to Social Actions*.

any finance minister,—namely, the budget of the prison, the gallies and the scaffold.” Or: “Society encloses in itself all the crimes committed. It prepares them, as it were, and the criminal is only the instrument which executes them.” “Every social state presupposes a certain number and a certain kind of crimes as a necessary consequence of its organization.” Declarations like these seemed to remove all responsibility from the criminal. He was not accountable for the action, which was the consequence of the social organization. At the most he was simply an unfortunate, and if for the safety of society it was necessary to shut him up, he ought to be viewed with compassion, and over the door of his prison be written, “Hotel des Invalides.” This in case both the number of crimes and the persons who shall commit them are fixed. If only the number is fixed, and individuals are still left some choice, then the criminal performs a work of supererogation, and should be rewarded by society. (Knapp).

In the same way Buckle seized upon the new statistical investigations to declare that the freedom of the human will was a phenomenon which at the best interested the individual himself, but in respect to society at large did not possess the slightest importance. For society is governed by unchanging laws in comparison with which the acts of individuals appear only as the slightest disturbances, and in fact as disturbances which in the long run neutralize each other. The investigations of statistics seemed to supplement those of natural science, and to furnish the crowning stone of the edifice,—a universe governed by natural law.

It is needless to say that the crude fatalism once deduced from statistics has long since been discarded by the statisticians themselves. They are better aware than any others of the insufficiency of their data and the incompleteness of their methods for sustaining any such position as that. Statistics reveal regularities, but they also reveal irregularities the moment you extend the investigation to other countries, or cover longer periods of time. These irregularities may be due to the freedom of the human will for all that statistics reveal to the contrary. Even the regularities may be due simply to the fact, that, under similar circumstances, men would act in a similar way. They do not point to any fixed and unchanging law, but simply to similar causes. Statistics cannot decide the question of the freedom of the will one way or the other.

If however we admit freedom of the will, what becomes of statistics as a science? If men can perform certain actions or not perform them as they please, where can we get any laws of society, or formulate any social science which shall be anything more than antiquarian research? But in statistics we are not content with saying, that there have been so and so many suicides in England regularly during the last ten years; we draw from that observation the further prediction, that, unless something unusual occurs, there will be about the same number during the next year. Statistical laws are thus simply observed regularities, which, if the condition of society remains about the same, may be expected to continue in the future. It is true that these laws are simply empirical laws, which may be overturned at any time. But they have the same force as many of the laws

of natural science which are reached by induction. I cannot tell certainly that the sun will rise to-morrow, but I am very sure that it will. I cannot say that sixty out of every million of the inhabitants of England will commit suicide next year, but, unless I know that some great change has taken place in public opinion, or in the economic or social condition of the people, or in the activity of the police, I shall expect to find that rate in the statistics of suicide next year. In other words, we take it for granted in statistics, that, even if there is freedom of the will, men act from motives and under influences, and that, these influences remaining the same, the actions will remain the same. There is no such thing as freedom of the will, understanding thereby the caprice of the individual. All statistical laws are formulated under this condition,—the stage of civilization remaining the same.

It is for this reason that one of the most important things in collecting statistics is to see to it that all the cases observed are of a homogeneous class. A life table constructed for the upper classes of Great Britain will be of little value when applied to the inhabitants of interior Africa. An average wage does not become of more, but of less value, by including in it the wages of women and children as well as those of men. Statistics of accidental and violent deaths would not be improved by including those who have been judicially hanged. It is just at this point that the trained statistician can exercise his skill with the most effect; for there is no fallacy more common than that a great number of cases will somehow yield a result which will be valid, however defective the original data. It is often said that the irregu-

larities will disappear, leaving only the normal. If the data are genuine, this is true; but if the data are false, the result will be false. If I am insuring only healthy lives, then the observation of a large number of healthy lives will give me a more trustworthy expectation of life than the observation of a few; but the result will not be helped by introducing a number of diseased lives because I could not get enough healthy ones.

Statistical science, therefore, can claim for its laws and regularities only a certain degree of authority. But there is abundant room for its efforts even in modern societies, as will appear from the following considerations:—In the first place, society in its main features changes slowly, so that in statistics we are able to follow these changes and adapt our conclusions to them. For instance, it is possible that the removal of the fear of future punishment for the deeds done in this body which rationalism has brought about among certain classes of society, may have had some influence on crime. It is quite certain that if the notion of hell were altogether removed from the consciousness of the lower classes, it would have some such effect. But it takes a long time to remove such a belief from the minds of a whole community, together with the influence it has had on their actions, and during that period statistics would have time to adjust themselves to the changed condition of things, or the old religious motives would have been replaced by other ethical ones having the same influence.

Again, the history of statistics shows that there are probably many more actions of men governed by general influences, such as climate, race, economic

condition, than we have any conception of at the present time. The great herd of common men have no very vigorous individuality, which would lead them to reach out beyond the influences immediately surrounding them. Once in a while we come across an individual who seems to fight his way out against all impediments, and to assert himself in spite of influences all tending the other way. But such an one is an exception. Is it not probable, that, for the mass of men, general influences have much greater power than is commonly supposed, rather than less? It will only be when we have refined our statistics so as to more clearly separate the causes, that we shall be able to answer this question, upon which the future of social science so largely depends.

In truth, one of the most useful functions of statistics is connected with this very fact,—that the results change with changing circumstances. Statistics observe not only regularities, but also irregularities. We study suicides with the aim, not only of discovering that they are regular, but that they are irregular, and the cause of the irregularity. The object is to direct social action towards changing the conditions, so that the evil which afflicts the social body shall be mitigated. It is precisely this which the temperance advocate does, when he shows the connection between intemperance and crime. He preaches the doctrine that if you change the cause you change the effect. All statistics rest on this basis of necessitarianism,—that like effects will follow like causes, and unlike effects, unlike causes. All hope of ameliorating the condition of society depends upon this law, and the more closely we can identify cause and effect, the greater hope we shall

have of being able to adopt such measures as will result in social improvement. Even Quetelet saw this clearly, and expressed it in words which ought always to be quoted with the sentences noted above, but which seldom are. After speaking of society as containing a certain number of crimes in itself as a necessary consequence of its organization, Quetelet goes on to say:

"But this ought not to discourage us, but ought to lead us to change if possible the organization of society,—for if we change the causes we shall necessarily change the effects. All hope of ameliorating the condition of society depends on this law that like causes produce like effects."

So also Venn points out, that, in making predictions in statistics, all we have any right to do is to predicate simple futurity, not necessity. Because there has been a regular number of suicides in England in proportion to the population, we can say that in the future there *will* be so and so many; we cannot say that there *must* be. And even this futurity is conditioned by the circumstances remaining substantially the same. We are apt, too, to turn this simple futurity, which is the law of the mass, into a constraint upon the individual, and to feel that the very fact, that there will probably be so and so many suicides in England next year, drives individuals to commit suicide. But there is no justification of this view. It may be true that the elevated railroads in New York city carry 150 million passengers a year, that is, the inhabitants of New York travel on the road an average of 100 times a year each. But that fact exercises no constraint upon me; I may never travel on the road, or I may patron-

ize it every day. The law of the mass has in itself no power over the individual.

Finally, to show how completely this modified form of necessitarianism is accepted by statisticians, we may quote from an author who is representative of the extreme believers in natural law and evolution, Morselli, the author of the work on "Suicide." He sums up the results of his investigation as follows :

"Suicide is not an act depending on the personal spontaneity of man, but certainly neither less than nor unlike ordinary births or deaths, crime or mental disease,—a social fact. Laws universal and constant and (so far as we can judge, if the external conditions are not modified) necessary, restrain within the narrowest limits the path of action assigned to each individual, and show that the psychical activities are obedient to the same influences to which all other activities of living organisms are subject."

"Suicide is an effect of the struggle for existence, which works according to the law of evolution among civilized peoples."

We are not concerned here with this law of evolution. Morselli shows it to be the feeble, the weak-minded, the vicious, the passionate, that commit suicide. The question is whether we have any control over suicide so that we can decrease it. Or is it subject to natural laws over which we have no control? Morselli's answer is that we can influence it. The apparent and direct method would be to diminish the severity of the struggle for existence, so that these weak persons should not be pushed to the wall. But this does not seem to be practicable. Notwithstanding all the resources of modern civilization, the struggle and competition between individuals seems to be as severe as ever. Hence we must use the indirect method. If we cannot diminish the severity of the struggle we may strengthen the character of

the individual, so that defeat in the struggle will not be so disastrous. The cure is : "To develop in man the power of well-ordering sentiments and ideas by which to reach a certain aim in life; in short to give force and energy to the moral character." But this is to acknowledge the freedom of the will.